8 Mediterranean, Near East, and Iran

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8.A Tools of Economic Activity in the Hellenistic and Roman Worlds: Empires and Coordination

I Introduction

The tools we consider here reshaped patterns of economic behavior both individually and in combination. In the case of the ancient Mediterranean and southwestern Asia, the broad shift was toward expanded patterns of coordination that promoted economic activities across larger physical distances and between disparate social groups. However, the tools could also limit access or concentrate economic power within narrow sectors of a society or market. The classic consideration of coordination is rooted in the discussion of market exchange, considering coordination as a way of reducing impediments to markets' optimal functioning.¹ Here, we consider the impact of tools not just on market integration but on other spheres of social coordination, for example hierarchies and formal networks.²

The state looms large in these discussions, as it had the most far-reaching organizational authority and some power to regulate economic behavior among its subjects. We therefore begin with a discussion of the fundamental toolset of the state – *fiscal regimes*, including taxation, spending, and monetary policy. Such regimes allowed central authorities to raise tremendous revenue and to spend it in ways intended to ensure the preservation of state power, generally benefiting the ruling coalition. In actuality, although control of fiscal regimes rested in the hands of a central authority, the processes of consolidating and redistributing the vast capital that flowed through state coffers were distributed. The configuration of responsibility to assess and collect taxes structured patterns of authority and sovereignty, creating economic 'winners' and 'losers' and shaping patterns of cooperation in the process. State spending, although directed at the survival of the state, promoted *monetization* that was both more intense and more widespread than in previous periods. The increased monetization, in turn, supported coordination of consumption, production, and distribution not just for the state but for the wider community.

Two other tools sit in close proximity to the state, *physical infrastructure* and *law*. The former covers large-scale physical projects generally undertaken by central

¹ Beckert 2009, 11–15.

² Manning 2011; G. Thompson et al. 1991.

authorities, like the construction of hydrological and transportation infrastructure. These projects generally increase productivity, ease distribution, and facilitate consumption, and in the long run increase coordination particularly in market contexts. Law, on the other hand, is an abstract tool that offers people access to rule-based relationships, with increased transparency and predictability that is associated with economic risk-taking. The expansion of legal systems across broad territories, as well as their accessibility to individuals from different social groups, aids intergroup coordination, allowing for the expansion of economic networks.

The final tools discussed, *standardization* and *technology*, are further removed from state power, at least in the context of the ancient Mediterranean and southwestern Asia. Although the friction-reduction benefits of standardization might be seen as a significant benefit of centralized power, the evidence for effective top-down standardization in critical spheres like weights and measures or language is limited. However, informal (i.e., not state-mandated) social standardization, particularly in the sphere of consumption practices, had dramatic consequences on production and distribution systems. Studies of technology, finally, tend to focus on the facilitation of increased production (e.g., more efficient harvesting and milling), and find ancient technological progress anemic. However, the importance of technology shifts if we consider instead developments that facilitated movement and therefore coordination. Under this lens, we find that technology played a critical role in facilitating robust, geographically distributed, segmented production systems.

Throughout, our focus will be on the ways that these tools facilitated economic activity, including production and consumption but with a particular focus on distribution and coordination. At the same time, we cannot ignore the social context of these tools. They emerged, evolved, and were maintained (sometimes consciously) as a result of the behavior of the actors discussed previously. Therefore, in addition to the impact that these tools had on economic behavior, we also address the impact of socially embedded actors on the tools themselves.

II Fiscal Regimes

Ancient empires could control and deploy economic resources on a scale that dwarfed any other actor. Some revenue came from plunder and indemnities in the course of warfare and was therefore mobilized by military power; some came from the state's/monarch's property and was therefore mobilized by the same institutions that underlay private individuals' economic power; but the most important sources of revenue, because they constituted the majority of states' income and impacted the largest number of people most consistently, were taxes. These were mobilized using the state's unique political power, which was often backed by military power. Most modern scholarship on fiscal regimes asks how fiscal policies shaped the dis-

tribution, durability, and exercise of state power.³ Our focus is different. We ask how fiscal regimes, including both the collection and deployment of resources, affected the economy at large. We therefore begin by reviewing briefly the types of taxes and methods of assessment that we find in the ancient Mediterranean and Near East. We then discuss the impact of this taxation by exploring the behavior of taxpayers, the effects of the ways that states deployed the resources they extracted, and finally the consequences of the methods of collection.

II.1 Revenues

Taxation, rent, and tribute in the Hellenistic and Roman empires cannot be understood as unified, rationally designed systems. The fiscal regimes of the Hellenistic kingdoms emerged out of the interaction of imported Macedonian administrative systems and preexisting Achaemenid and local structures, and tended toward extensive and increasingly centralized intervention. In the subsequent period, as Romans conquered the Mediterranean basin, they adopted local methods of taxation and developed new ones on an ad hoc basis. Although more centralized than the Hellenistic kingdoms, the Roman government did not seek to standardize taxation across the empire.⁴ There was a trend toward more state involvement in revenue collection, but there was never a single unified system of tax assessment or payment, nor a concerted attempt at one in our period.

II.1.1 Types of Taxes

Although collected under a huge number of names, the dominant taxes in both the Hellenistic and Roman systems can be divided into three broad categories: taxes on agricultural products and land, taxes on individuals including poll taxes as well as forced labor levies, and indirect taxes on transportation or movement. Further indirect taxes were also levied on a range of other transactions like the sale and manumission of slaves, specific types of production activity, and inheritance, while particular social groups were often subjected to special direct taxation as well. There were also special-purpose taxes levied for particular needs and exigencies.

Taxes on agricultural production as well as rents paid for royal/imperial land constituted a significant portion of state income across this period.⁵ Seleukid royal

³ Monson and Scheidel 2015 for an overview. Two important exceptions, however, are Keith Hopkins (1980; [1995–1996] 2002) and Peter Bang (2007; 2008), who focus on the economic impact of imperial taxation.

⁴ For brief overviews of Roman taxation, see Brunt 1990, 324–346; Rathbone 1996; Bowman 1996; Eck 2000a; Lo Cascio 2007. Attempts at greater standardization began at the end of the third century CE.

⁵ On the Ptolemaic world, see Manning 2003, 57, discussion in von Reden 2007, 89–90. For Roman revenues, Scheidel 2015, 160–163.

lands, the vast tracts of territory that fell beyond city and temple control and were claimed by the kings, were subject to a tax called the tenth (*dekate*) or harvest tax (*ekphorion*). Lands not directly administered may also have been subject to a fixed-rate tribute, the *phoros*, although the basis on which this was assessed and its relationship to the proportional taxes mentioned above is unclear. Agricultural production and land taxes in Ptolemaic Egypt, where more is known, varied both by the crop grown (e.g., grain-land vs. orchards) and the type of land it was grown on (e.g., crown- vs. temple- vs. *kleruchic* land). *Kleruchic* lands were also subject to a range of taxes related to either cultivated plots or volumes of yield.⁶ The line between taxes and rents was fairly fluid, such that Ptolemaic temple lands were subject to an *ekphorion* that cut across rents to temples and taxes to the state. The key land tax in the Roman Empire, meanwhile, was the *tributum soli*, which was levied on noncitizens.

A range of types of capitation taxes were collected by Hellenistic kings. From the Ptolemaic world, the earliest was the salt tax, in force during the second half of the third century BCE.⁷ There were other levies placed on individuals throughout the Ptolemaic period, including a tax on priests and a later tax on all men, whose nature remains debated.⁸ In the Roman sphere, we have concrete evidence for poll taxes (*tributum capitis*) from Egypt and Judaea, and these are usually taken to have been a regular feature throughout the empire.⁹ Revenues related to the movement of people and goods were collected, including duties and taxes or fees related to infrastructure use (e.g., port fees or tolls). Indirect taxes in both the Hellenistic and Roman worlds also included a range of types of compulsory service, including military conscription, forced labor, and liturgies.¹⁰ The latter, called *munera* in Latin, were specific tasks imposed on people based on their financial and professional status, often at the municipal level. Many vital governmental functions, including tax collection, were performed by liturgists serving limited terms. Taxation, therefore, varied greatly not only by time and place but also from person to person.

II.1.2 Methods of Assessment

The question of assessment concerns tax rates, how these were calculated (e.g., as a proportion of the harvest or a fixed quantity relative to the amount of land), and the form in which they were to be paid (cash or kind). The tax rates paid on agricul-

⁶ Von Reden 2007, 92–94.

⁷ Clarysse and Thompson 2006, ch. 3.

⁸ See Monson 2019, 154.

⁹ Rathbone 1993 for Egypt; Alon 1980, 64–66 for Judaea; Neesen 1980, 117–135 for the empire at large.

¹⁰ Hellenistic: Reger 2003, 343–345 (*polis*-context). Roman: Brunt 1990, 188–214 (conscription); Lewis 1997 (liturgies).

tural products are difficult to track. This problem is particularly acute in the Seleukid kingdom, where we have little concrete information about tax assessment even for critical crops like grain cultivated under direct control of the king.¹¹ There is, however, evidence for the increasing role of cash rather than in-kind tax collection across the Seleukid sphere.¹²

Records concerning Ptolemaic taxation are far more detailed. There was, on the one hand, a grain economy which produced cereal crops whose harvest taxes were calculated in kind and used to supply urban centers. The *ekphorion* rent for crown land ranged dramatically depending on land quality and annual climatic considerations as determined during pre-harvest surveys of land.¹³ Other categories of land were assessed at different rates. The taxation rate for *kleruchic* land, for example, eventually fell quite low, amounting to only one *artaba* per *aroura* in the late second century BCE.¹⁴ Other agricultural products were taxed differently. The *apomoira* for fruits or wine, usually one-sixth of the harvest, were assessed in monetary terms – they would often have been collected in kind but then converted to cash before flowing to the central authority. In yet other cases, the unit of collection is specified as bronze coin, which suggests a local purpose for the revenue raised, since bronze coins were emphatically local.¹⁵ Many of these taxes were commutable into other units, however, with grain and coined money serving as base units.

Despite the reasonable state of Roman evidence, agricultural taxation remains a murky subject. In one brief passage, a land surveyor of the second or third century CE writes “In some provinces, they pay a definite portion of the produce, some one-fifth, others one-seventh; others pay cash, and this is based on an evaluation of the land.”¹⁶ Unfortunately, we have no comprehensive list of which provinces were taxed in which way, and we know that the details changed over time.¹⁷ Judaea paid taxes in kind under Julius Caesar, but in the census decreed by Augustus, residents of Syria (including Judaea) had to declare their property in money. Appian, writing in the second century CE, says that Syria paid a property tax of one percent.¹⁸ Forms of payment also varied by crop. In Roman Egypt, we know that taxes on grain land were collected in kind, while taxes on vineyards and olive groves were collected in coin, as in the Ptolemaic period.¹⁹ The same was true in at least some parts of the province of Asia.²⁰

11 Kaye 2018.

12 Van der Spek 2004.

13 Monson 2015, 182.

14 Monson 2019, 153.

15 Von Reden 2007, 87.

16 Pseudo-Hyginus, *Establishment of limites*, 205L, trans. Campbell 2000, 161.

17 Duncan-Jones collects the scattered evidence for taxation of provinces in money and in kind (1990, 187–198).

18 Duncan-Jones 1990, 189; Safrai 1994, 145, 351–352 for Judaea.

19 For taxation in Roman Egypt, see Rathbone 1993.

20 Duncan-Jones 1990, 192.

Assessment was probably based more often on the amount of cultivated land rather than the harvest. Usually, the land tax was not actually collected from individual landowners but from the city in whose territory the land was situated, and cities could be granted tax relief on account of natural disasters.²¹ Had land taxes been assessed on the harvest itself, such relief would have been unnecessary. On imperially owned estates, in contrast, rent was normatively paid as a share of the harvest. This might have discouraged investment (see below), but the emperor offered other incentives, e.g., the right to cultivate unused land and temporary remission of rents for those planting vines and olives.²² Egyptian papyri, however, reveal complications and flexibility here as well. Rents on imperial estates were supposed to be assessed each year in response to the quality of the Nile flood, but in practice they settled at fixed average rates. Furthermore, the cultivators could commute their obligations between crops at fixed rates of exchange and might have been able to pay in money as well.²³

In contrast to agricultural productivity taxes, which were paid in a variety of ways, capitation taxes were generally fixed and assessed in cash. The Ptolemaic salt tax, for example, was due on all individuals, free and slave, and was invariably paid in cash, making it one of the central monetization vectors for the population as a whole. In the Ptolemaic world, these taxes, along with a range of taxes tied to production, consumption, or sale of specific products, were paid in cash²⁴ and assessed according to tax registers held at the local level, and not by means of a regularized, centralized census.²⁵ The Roman poll tax, the product of a more organized census, also varied from place to place and according to gender and age, with certain occupations and ethnicities (most famously the Jews) paying extra personal taxes.

Another category of taxes generally paid in cash are customs duties. In the Ptolemaic world, for example, these were collected on goods shipped into Egypt along with a range of other transaction costs like port fees related to shipping.²⁶ Our best evidence about the amount paid comes from the Zenon archive, which demonstrates that the duties on luxury imports could reach 50 percent, a very high rate with respect to other known Mediterranean contexts.²⁷ Roman customs duties were also

²¹ Brunt 1990, 339–343.

²² These arrangements are known from epigraphic evidence in North Africa, where imperial holdings were particularly extensive (Kehoe 1988).

²³ Rathbone 1993, 84.

²⁴ E.g., taxes connected to the the *kat' ethnoi* records, von Reden 2007, 104–107 for discussion and bibliography.

²⁵ On which in general, Clarysse and Thompson 2006.

²⁶ These include payment for the upkeep of the navy, a land transportation surcharge, and a harbor fee (Gabrielsen 2013, 72). On customs duties in Ptolemaic and Roman Egypt generally, see Sijpesteijn 1987.

²⁷ Bresson 2012.

primarily levied in cash,²⁸ with one major exception: the 25 percent tax on imports into the empire. The Muziris Papyrus implies that imports coming from the Red Sea through Egypt were taxed in kind.²⁹ Taking taxes in money from the eastern trade would have been difficult, as the cargoes were so valuable that few merchants would have had enough cash on hand to pay.

II.2 The Economic Impact of Fiscal Policies

II.2.1 Taxpayers

For individual taxpayers, the most basic impact of imperial fiscal policies would have been the need to increase surplus production. Beyond the need to maintain a certain pre-tax level of consumption, certain forms of taxation might have incentivized or discouraged investments to further increase production, and changes in taxation could have far-reaching impacts on the distribution of wealth. Andrew Monson has made such a case for Egypt.³⁰ In the Ptolemaic period, crown lands were extensive, and these were subject to taxation assessed as a portion of the harvest (see above). If a landowner invested in improvements that increased the harvest, the state would capture a portion of that increased production. In the Roman period, more of the arable land was private, subject to the fixed rate of one *artaba* per *aroura*. In this case, any increase in productivity due to land improvements would be entirely captured by the owner. At the same time, the owner bore all the risk for poor harvests. Over the long term, this would favor wealthy cultivators at the expense of poor ones, who were more susceptible to harvest shocks and had less capacity to invest. That such a scenario occurred in Egypt, Monson argues, is shown by the increased use of water-lifting technology, a dramatic increase in the price of land, and the rise of an aristocracy based on landed wealth similar to what is known from other parts of the Mediterranean. While this shift in the method of assessing taxes might have increased overall production, it likely did so at the expense of the less wealthy cultivators for whom the combination of a poor harvest and an inflexible tax demand would have spelled ruin.

Taxation might also have incentivized monetization and increased commercial activity. Agriculturalists paying taxes in kind could simply increase production, but to pay a monetary tax – a poll tax, for example – one had to acquire coins, which usually meant selling one's produce or labor at market. So, for example, in Egypt

²⁸ Duncan-Jones 2006, 7.

²⁹ SB 18. 13167. Von Reden, vol. 1, ch. 8.C, 369–370 for an introduction. The latest account of this much-discussed document is De Romanis 2020, who argues, contrary to the dominant opinion, that this tax could be collected in money.

³⁰ Monson 2012.

the Ptolemies introduced monetary poll taxes as part of a broader suite of institutional reforms meant to encourage monetization.³¹ Monetary taxation thus forced payers to engage in economic behaviors that brought them into new types of relationships with others and to participate in broader economic networks. The breadth of these networks becomes clearer when considered at a regional level.³² Imperial states demand taxes from one region and deploy that wealth elsewhere. In the Roman Empire, this is particularly clear. The imperial state invested most of its wealth in the capital city and Italy, which paid no land or poll tax, and in the military stationed along the frontier, much of it in continental Europe, which was less wealthy than the Mediterranean regions. To sustain this continual drain of money, the tax exporting regions had to buy back their money by selling goods to the tax importing regions. The extraction of taxes, therefore, would have contributed to economic integration not only by moving goods and money from one place to another, but by triggering a secondary return movement of goods and money.³³

II.2.2 Deployment

Commercial markets might also have benefited from the actions of the tax-collecting state. There was often a mismatch between the resources that taxpayers could provide (usually goods) and the resources that the state required (usually money), and the state would often sell in-kind taxes on the market.³⁴ The Roman state certainly sold some of its tax grain in Rome, which allowed it to stabilize the grain market in the capital and take advantage of the high prices in the city.³⁵ On the other end of the commercial spectrum, we know that the state sold the balsam resin from the imperially owned balsam groves,³⁶ and it might have sold some of the goods it collected from the 25 percent tax on eastern imports. The need to convert taxes to money, then, would have helped to ensure a steady supply of goods to the market, encouraging buyers and traders to enter the market and promoting knock-on activities like financial intermediation. The same dynamic would have applied on a smaller, more dispersed scale to landlords who extracted rents in kind and sub-imperial states.

Of course, the purpose of extracting taxes was to concentrate resources in the hands of the state, and the concentration of resources at an imperial scale brought with it possibilities and conditions that had not existed before. The impacts of such

³¹ Von Reden 2007.

³² Hopkins 1980; (1995–1996) 2002.

³³ See, however, Weaverdyck, ch. 12.C, this volume for complications.

³⁴ Bang 2007; 2008.

³⁵ For the meager evidence, see Garnsey 1988, 238–239.

³⁶ Pliny, *Naturalis historia* (Plin. HN) 12. 54.

concentration are particularly apparent when we examine the two areas on which the Hellenistic and Roman empires spent most of their revenue: the military and patronage in core regions. The economic impacts of military spending were discussed in chapter 3.A, above, so here we focus on the patronage of cores.

In order to survive politically, ancient imperial states had to patronize certain powerful constituencies and, in a related process, spend money to create the image of wealth and power. In the Hellenistic systems, the investment in urbanism and the structured relationship between kings and their *philoï* discussed earlier were the most economically significant draw on resources. In the case of Rome and the Ptolemies, this meant pouring vast amounts of wealth into a relatively concentrated geographic area. The Roman imperial state funneled resources to the capital city in various ways: A free grain dole fed hundreds of thousands (and indirectly supported markets in other goods);³⁷ the emperors built monumental temples, baths, basilicas, and other infrastructure that provided not only the urban fabric of the capitol, but jobs; they also distributed money (called *congiaria*) to the populace and provided spectacles; the imperial household's consumption was exceptional in quantity and quality, and at least some of this must have been purchased; the imperial household and administrators earned salaries; and a portion of the military budget went to soldiers stationed in Rome.³⁸ In addition, because proximity to the emperor was the key to social advancement, imperial elites spent money in Rome that they extracted as rents from properties scattered across the empire. If Hopkins's estimate that imperial elite income was of the same order of magnitude as the imperial state's non-military expenditure is correct,³⁹ this nongovernmental channel might have funneled as much money to Rome as the state did. The result was a megacity with a voracious demand for capital of all kinds (including human, since the high population density led to higher mortality rates) and consumers willing to pay higher prices than anywhere else in the empire, which stimulated trade, division of labor, and a flow of immigrants (some of them seasonal) that drained other regions of surplus labor.⁴⁰ Ptolemaic investments in Alexandria must have produced a similar dynamic, although the details would have varied.

The Seleukids, on the other hand, had no such single dominant urban center. Although Seleukeia-Tigris and Antiocheia were the most important cities in their empire, Seleukid urban patronage was more geographically dispersed. In seeking to understand the development of this immense urban network, Aperghis has pro-

37 Tchernia 2016, 103; Weaverdyck, ch. 12.C, this volume.

38 Estimates of total Roman state expenditure rarely differentiate between expenditure in Rome and elsewhere. Scheidel 2015 provides a good, recent overview; Duncan-Jones 1994, 33–46 is more detailed.

39 Hopkins (1995–1996) 2002, 208

40 For the economic impact of the city of Rome, see Morley 1996; Hopkins (1995–1996) 2002, 219–225. Erdkamp 2016 emphasizes the role of cities in providing opportunities for underutilized agricultural labor.

posed a controversial model that sees city foundations as explicitly economic: the cities mobilized underutilized landscapes and provided marketplaces that converted agricultural produce into cash income for the royal treasury.⁴¹ As Boehm has recently pointed out, the model at once overstates the scale of monetization, and flattens the multifaceted economic dimensions of Seleukid cities, with urbanization contributing not only to royal economies, but also to those of the cities themselves.⁴² Much of the patronage that Seleukid dynasts bestowed on these new cities came in the form of alienating royal lands to civic authorities and prominent citizens, expanding and diversifying land ownership. The practice of devolving lands to individuals, and then further allowing those individuals to attach their estates to a *polis* empowered both the prominent citizens, and the *poles*. This resulted in a class of newly landed elites with concentrations of wealth dispersed across the landscape. Atop this network, Boehm has also tracked the emergence of regional urban leagues – *koina* – which, along with the practice of *synoikism*, bound smaller cities together into a regional framework.⁴³ Seleukid investment in urbanism, then, promoted more dispersed economic development. The absence of a single primate capital city, however, implies an economy that was simultaneously more regionally egalitarian and less integrated.

II.2.3 Collection

As in any premodern tax system, there was a certain amount of friction and leakage in the process of collection. The tax collectors always kept some portion of what was collected for themselves. Therefore, the configuration of the tax collection system also influenced the distribution of wealth within society at large, rather than just that of the central treasury. Tax collectors could be intrinsically state agents acting on behalf of and paid directly by the state (e.g., Roman imperial freedmen or Ptolemaic state agents), political or administrative organizations subordinate to the state that collected taxes on their land and paid taxes out of that income (e.g., temples or cities), or individuals and organizations that bought the right to collect taxes, as in the case of tax farming. We know most about Roman and Ptolemaic tax collection.

The Ptolemaic tax farming system functioned somewhat differently from the standard formulation, with implications for the distribution of wealth. Although the tax farmers still bid on the right to collect taxes, they themselves did not actually collect the money owed.⁴⁴ Rather, their bid acted as a guarantee of cash income to the state, secured by sureties and in some cases mortgages. They then oversaw the

⁴¹ Aperghis 2004, 97–101.

⁴² Boehm 2018, 104.

⁴³ Boehm 2018, esp. ch. 2.

⁴⁴ See discussion in Bingen 2007, 160–169.

records concerning tax collection, while state officials provided the labor. Banks at the *nome* level took deposit of the tax contributions, and facilitated the transfer of revenue to the central treasury. This system of tax farming acted as a check on the predatory behavior of state officials by reducing their ability to consolidate financial resources, while also limiting the excesses of the tax farmers by forcing them to rely on state officials to collect revenue. The regularized involvement of banks added another level of oversight – with accounts balanced on a monthly basis – and helped to ensure that money flowed smoothly and at regular intervals through the system.⁴⁵ However, the attempts were not always successful, as official malfeasance appears to have increased in periods of political instability.⁴⁶

The Roman Empire relied on a variegated and changing system of tax collection. Although state representatives oversaw collectors, the evidence for their involvement in direct collection is shaky.⁴⁷ In most cases, taxes were collected either by tax farmers or by civic governments who paid the state either directly or through the intermediation of tax farmers. The outsized role of tax farmers (*publicani*) in the Late Republic has attracted attention because they appear politically powerful in the literary sources of the period.⁴⁸ At this time, most provincial tax collection contracts were auctioned at Rome, and the *publicani* who bid on them were members of the equestrian order. As such, they cast influential votes in elections and sat on juries in corruption trials of former magistrates. This gave them a great deal of influence with the senatorial governors meant to oversee their activities in the provinces.⁴⁹ While various institutional structures limited their bargaining power relative to the state and to taxpayers, the difficulty of oversight and a lack of willingness to enforce limits allowed the *publicani* to exploit provincials.⁵⁰

The scope of the *publicani*'s operations could be very large. In the late second century BCE, when Rome took over the Attalid kingdom as the province of Asia, contracts to collect taxes throughout the entire province were auctioned at Rome.⁵¹ To collect these taxes and pay the resulting revenue into the Roman treasury, the *publicani* had to control huge amounts of capital and oversee an elaborate system of physical and human infrastructure. *Publicani* generally acted as companies (*societates*) with many partners (*socii*), headed by a *manceps*, governed by a board of *magistri*, and represented in the province by an officer called *pro magistro*, who oversaw the employees, slaves, and infrastructure required to carry out the business of tax collection. Whichever company won the right to collect taxes probably took

45 On the role of banks, see von Reden 2007, 168–178.

46 Monson 2015, 185.

47 The *procurators* that appear during the Principate are as likely to be overseers of tax farmers as tax collectors (Brunt 1990, 354–432).

48 Tan 2015; 2017, 40–67 with further literature.

49 This influence is especially evident in the writings of Cicero (Davenport 2019, 84–93).

50 Tan 2017, 45–54.

51 Kay 2014, 76–82; Tan 2017, 60–65.

over the provincial substructure intact from their predecessors.⁵² In contrast to most partnerships in Roman law, these *societates* resembled much more closely a modern corporation in that they were not dissolved by the death or withdrawal of a partner.⁵³ This gave them potential longevity beyond that attainable by other, purely commercial organizations. Tacitus says that some companies founded during the Republican period were still operating under Nero (r. 54–68 CE).⁵⁴

In the principate, the role of tax farming had changed.⁵⁵ In 47 BCE, Julius Caesar abolished the contract for Asian land taxes and had local communities pay his representatives directly.⁵⁶ Simultaneously, he cut the tax rate by one-third. This not only demonstrates the level of profits that the *publicani* had enjoyed,⁵⁷ it reveals a shift in the political landscape. For Caesar, the support of the cities of Asia and their local elites was more important than that of the equestrian *publicani*. This is seen as the beginning of a general shift away from the use of *publicani* in direct taxation, but the timing of the shift is not entirely clear.⁵⁸ In any case, under the monarchy both the political careers of governors and the business opportunities of the *publicani* depended more on the emperor than on each other.⁵⁹ Gradually, the emperors also increased oversight of the *publicani* by placing them under the supervision of imperial *procuratores* and their staffs.⁶⁰ Thus, a larger share of the extracted revenue would have ended up in the imperial coffers rather than in private hands. Nevertheless, the *publicani* remained important players in the imperial economy. They still dominated the collection of indirect taxes in districts that could span multiple provinces.⁶¹ The so-called *portorium publicum Illyrici*, for example, was collected in all the provinces from the source of the Danube to its mouth.⁶² On the other hand, these taxes were no longer farmed from Rome, but in the provinces themselves, expanding the opportunities for enrichment.⁶³

When the local elites who sat on city councils were made responsible for collecting land taxes, they had the same opportunities to profit through over-exaction as

⁵² Badian 1972, 67–81; Brunt 1990, 360–375. For the employees, see Nijf 2008.

⁵³ Brunt 1990, 368–376.

⁵⁴ Tacitus *Annals* 13. 50.

⁵⁵ Brunt 1990, 354–432; Davenport (2019, 84–93, 197–201) analyzes the power of tax farmers in the Republican and monarchical ruling coalitions.

⁵⁶ Appian *Bellum civile* 5. 4; Cassius Dio (Cass. Dio) 42. 6; Plutarch *Life of Caesar* 48.

⁵⁷ Brunt 1990, 380.

⁵⁸ Brunt (1990, 388–393) argues for a relatively quick change, but see Sirks 2018, 107 for the debate.

⁵⁹ Davenport 2019, 192–201.

⁶⁰ Brunt 1990, 381–386; Eck 2000a; 2000b, 283–286.

⁶¹ Brunt 1990, 407–414. Günther 2008 for indirect taxation. The preservation of a series of decrees concerning the collection of transport taxes in the province of Asia has contributed a great deal to our knowledge of indirect taxation (Cottier et al. 2008).

⁶² Ørsted 1985; but cf. Brunt 1990, 425–427.

⁶³ Brunt 1990, 393.

the *publicani*, although their dependence on their fellow citizens for political support might have stayed their hand somewhat. In any case, estimates of imperial expenditure and revenues during the Principate reveal a significant gap between what was nominally owed in direct taxation and what the imperial government took in.⁶⁴ Whatever the amount, the revenues from tax collection not captured by the imperial state were now in local hands, either those of the elite or of provincial *publicani*. While the taxpayers may (or may not) have kept more of their money, this would have restricted the geographic scale at which capital circulated.

The political power of ancient empires allowed them to force increased production and move huge amounts of resources (goods, money, and people) out of the regions in which they were produced. The economic impacts of this can be seen from the perspective of the taxpayers or the state, but it is also critical to examine actors who do not fall neatly into these categories. Temple and city elites and tax farmers all stood to benefit from the imperial state's demand for taxes. Roman tax farmers in particular built geographically extensive and chronologically stable organizations with the support of the state. Imperial demand for taxes created a framework within which others operated, be they taxpayers, tax collectors, the inhabitants of a capitol, or merchants buying and selling tax goods. Perhaps the most far-reaching impact of these imperial frameworks in the ancient Mediterranean and Near East was monetization.

III Monetization

By 300 BCE, the idea and institutional foundations of money were well established in many parts of ancient southwestern Asia and the Mediterranean world.⁶⁵ The most important changes that occurred in the six centuries under consideration here concerned the scale of the money supply and the fluctuating extent of monetary networks, including the creation of the *denarius* network.⁶⁶ In the late fourth century BCE, Alexander the Great captured the Achaemenid royal treasury, turned it into coin, and dispersed it, dramatically increasing the amount of money in circulation. Greater mining activity particularly under the Romans would further increase the money supply until the second half of the second century CE. While coined metal always constituted the bulk of the money supply, banking and credit institutions increased it further and eased its deployment. The development of monetary networks followed a less linear dynamic. Alexander minted his coinage on the already widespread Athenian weight standard, creating a vast if probably patchy monetary

⁶⁴ Scheidel 2015.

⁶⁵ Von Reden 2010; Manning 2018, 195–202.

⁶⁶ *Sensu* von Reden 2010, 65–91.

network spanning the Eastern Mediterranean. Its reach was never universal, however, and it soon fragmented into multiple regional currency zones. The Roman Empire created a second massive and even more durable currency zone in the Western Mediterranean, but only partially integrated the former Hellenistic territories. Some of these monetary networks were closed while others overlapped or were partially coordinated, with multiple currencies in use simultaneously and circulating at different scales.⁶⁷ This complexity would have added to transaction costs, especially for interregional trade.

The production of coinage in the ancient Mediterranean and Southwest Asia, in contrast to China and South Asia, was always the purview of the state. One influential argument has been that ancient states minted coins exclusively to cover their own (primarily military) expenses.⁶⁸ This view is now routinely critiqued.⁶⁹ State expenses certainly played a role, but the functionality of coins cannot be divorced from the sociocultural contexts in which they had value. From the perspective of the state, ideological and fiscal concerns, and perhaps even a desire to facilitate commerce, may have been other important goals. But in order to truly understand monetization, we must shift away from seeing the state as a totalizing entity and focus instead on how monetization interacted with the goals of the various actors and interests that constituted ancient states.

We address the question of state involvement in coin production at the end of this section. First, we describe different forms of money in this space, focusing on the *drachm*-based and *denarius*-based coinage systems, but also addressing bullion and credit. Here, the emphasis is on the growth in money supply and changes in the scope of monetary networks.

III.1 Forms of Money in the Ancient Mediterranean and Southwestern Asia

III.1.1 Bullion

Bullion was a medium of exchange in the southwestern Asia for some two millennia before the advent of coinage.⁷⁰ Bullion was a commodity in its own right while also fulfilling some monetary functions as a privileged medium for payment and a measure and store of value. The developmental relationship between bullion, hacksil-

⁶⁷ See contributions to Metcalf 2012 for overviews and further literature on the various coinages of the Graeco-Roman Mediterranean.

⁶⁸ Crawford 1970.

⁶⁹ In particular by Lo Cascio 1981. Howgego 1990 has also been influential. See Woytek 2018, 16–17 for more recent literature.

⁷⁰ Le Rider 2001.

ber, and coinage remains unclear, and it is possible to argue about how ‘monetary’ these instruments were. However, for the present purposes, it is enough to note some of the general contours of bullion as they relate to the expansion of monetization.

Bullion was used in Near Eastern state accounting and was disbursed as loans already in the second millennium BCE.⁷¹ The concept of reckoning accounts in weighed metals came later to the Mediterranean, but monetary silver in a similar sense is referenced in early Athenian law, and inscriptional evidence attests to its use in Greek Asia Minor in the late seventh/early sixth century BCE.⁷² Although a variety of monetary instruments were used simultaneously in Greece as elsewhere,⁷³ coinage took off in the Aegean world. It adopted and expanded the functional sphere of bullion, became the dominant physical instrument of exchange, and expanded monetization dramatically. As Kroll has pointed out, however, monetization began with bullion, suggesting that “the employment and increasing supply of precious metal was probably more influential than the form in which it was transacted.”⁷⁴

Even after the advent of coinages, bullion was slow to disappear. In the Greek world, it remained a form of money particularly for storing large quantities of wealth. In the Roman context, beginning perhaps in the late sixth century BCE, bronze bullion (*aes rude*) constituted the earliest monetary instrument based on metallic weight, with bronze bars and minted bronze coins following thereafter.⁷⁵ Bullion, however, continued to be used, and although the scale of its use is debated, it served as a medium of transaction, storage, and measuring into the Principate.⁷⁶ In the Near East, the role of bullion was more stable, with widespread adoption of coinage only after the conquests of Alexander the Great in the late fourth century BCE. Although bullion and coinage can fulfill similar functions as monetary instruments, their relationship to the state is fundamentally different. Bullion functions more or less independent of centralized authority, whereas coinage both relies on and promotes a recognized authority.

III.1.2 *Drachm*-Based Coinage Systems

In the aftermath of Alexander the Great’s conquests, a new monetary system came to dominate the region. In contrast to the classical Mediterranean, where independ-

⁷¹ Van de Mieroop 2005 on silver in loans.

⁷² Kroll 2008, 18–21.

⁷³ Schaps 2008.

⁷⁴ Kroll 2008, 37.

⁷⁵ Crawford 1985.

⁷⁶ Hollander 2007, 31–39.

ent cities were the central locus of coin production and when a multitude of weight standards competed for primacy, and in contrast to the Achaemenid Empire, with its limited and uneven use of coined money,⁷⁷ the world of Alexander and his successors saw the rise of interregional royal coinages, organized and coordinated at the highest levels of the new massive states. The Hellenistic period, therefore, introduced a level of standardization to coinage systems hitherto unknown, despite the diversity that nevertheless persisted both at a local level and between the major powers.

The system that was introduced by Alexander in the late fourth century BCE had three principal denominations, one gold (the stater) and two silver (the *tetradrachm* and *drachm*). The weight standard was based on that of the city of Athens, with a silver *tetradrachm* weighing 17.2 g. In a radical departure from earlier practice, these coins depicted the living monarch himself.⁷⁸ By the end of Alexander's campaigns, 25 mints were minting his coinage in massive quantities, using the treasure of the Achaemenid Empire to facilitate the overwhelming scale of production: It has been estimated that four million *tetradrachms* were minted between 333 and 318 BCE at the Babylon mint alone.⁷⁹ *Drachms* and *tetradrachms* minted in the name of Alexander proved to be remarkably enduring, with posthumous issues produced long after the monarch's death by both 'official' mints of the successor kingdoms and those of various cities, as well as in territories beyond the political borders of the Hellenistic monarchies.⁸⁰ Beyond the silver denominations, there was also an increased production of gold coinage early in the Hellenistic period, which expanded the raw quantity of wealth circulating as coinage considerably. This was relatively short-lived, however, as outside of Egypt the minting of gold denominations dropped precipitously after the Diadochi.⁸¹ At the same time, the age of the successors also saw an increased minting of bronze issues. Ptolemaic mints issued bronzes in large numbers, but royal production of bronze is also attested in Seleukid and Attalid contexts as well as at numerous civic mints.⁸² Speaking extremely generally, the sum effect of these changes in minting practice served to speed up and expand the sphere of monetization and to ensure that coinage served as the financial instrument in an ever-wider range of transactions, replacing earlier traditions of weighed silver.⁸³

As royal coins flooded the market, the volume of civic issues plummeted.⁸⁴ Although the process has been seen by some as a sign of aggressive state intervention

⁷⁷ For an overview of Achaemenid imperial coinage, Tuplin 2014.

⁷⁸ On the role of this personalization, see Fabian and Weaverdyck, ch. 3.A, this volume.

⁷⁹ Meadows 2014, 178.

⁸⁰ E.g., the 'imitative' issues of Arabia and the Caucasus, Arnold-Biucchi 1991; Dadasheva 1976.

⁸¹ De Callataÿ 2014, 60–65.

⁸² On the royal bronze issues, de Callataÿ 2014, 73–77.

⁸³ See Taasob, ch. 8.B, this volume.

⁸⁴ Although this process was neither immediate nor absolute, see discussion in Mørkholm 1991, 85–95.

in local monetary systems, it is in fact unlikely that the decline resulted from an intentional state policy to control currency systems for either profit-making or power-consolidating motives. Instead, the decline can be seen as the natural response to the production of a vast quantity of royal issues combined with their quick and wide dissemination, which made them low-friction currencies relative to civic issues, and therefore brought benefits to users.⁸⁵

Even in the case of Egypt, where a closed currency system developed with relative rapidity following the reduction in weight of the Ptolemaic *tetradrachm* to 14.9 g. by 300 BCE, von Reden has argued that the development of the imperially regulated system that followed was a reaction, rather than a premeditated choice.⁸⁶ The initial decision to reduce the weight of *tetradrachms* by Ptolemy I sprang from the surge in demand for coinage in the late fourth century BCE and the limited silver supplies of the kingdom at that time. The reduction in weight encouraged the hoarding of full-weight coins, which led eventually to the formalization of the closed currency zone, allowing the Ptolemaic mints to capture profits from the re-minting of the heavy-weight foreign currencies.⁸⁷ Similarly, the expansion of the bronze coinage system in Ptolemaic Egypt is another phenomenon that was clearly the subject of intense state interest, but where the relationship between initial motivations and end effects is difficult to untangle.⁸⁸ It is clear, however, that Ptolemaic monetary policy resulted in a profound intensification of monetization, particularly in the Egyptian countryside. This argument highlights the fact that even the clearest example of imperial manipulation of coinage systems in the Hellenistic world should be understood as part of a complex feedback loop between local conditions and imperial opportunities, with the initial underlying intentions often difficult to reconstruct.

III.1.3 *Denarius*-Based Coinage System

Rome's coinage system would eventually unify not only vast areas where it circulated but also, with its various denominations, disparate scales and types of transactions. However, even here, friction and diversity persisted. Rome's monetary instruments began to dominate high-value exchange in Italy already in the mid-third century BCE, before the introduction of the *denarius*, but debasement during the second Punic war destroyed confidence in Roman money.⁸⁹ In response, the Romans issued a new, very pure silver coin, the *denarius*, along with several other

⁸⁵ See discussion of positions in Meadows 2014, 182–184.

⁸⁶ Von Reden 2007, 43–48.

⁸⁷ Von Reden 2007, op. cit., especially 43.

⁸⁸ Von Reden 2007, ch. 2.

⁸⁹ Burnett 2012.

bronze and silver denominations that were explicitly integrated into a single system through value marks (gold coins, first minted regularly from the 40s BCE, were also integrated).⁹⁰ At the same time, Rome also minted an alloyed silver coin that bore no numbers, perhaps for use in areas that had previously used *drachms*, showing the limits of the state's ability to impose homogeneity.⁹¹ Even more tellingly, the value of the bronze and silver coinages fluctuated against each other. In the 140s, it was necessary to retariff the *denarius* at 16 asses instead of 10. Even during the Principate, there is evidence that the value of the *denarius* in asses varied from place to place.⁹² Nevertheless, coinage of different metals was considered comparable in value, and the state's endorsement of fixed ratios of value must have provided some stability. Thus, the forms of money used in small-scale transactions could be converted into larger denominations, but the process was not frictionless.

Soon after the *denarius* was introduced, non-Roman silver coins were withdrawn from circulation in Italy, though non-Roman bronzes continued to circulate in the second century BCE.⁹³ The *denarius* system spread through Africa and Spain, and later into Gaul so that, by the mid-first century CE, it was the only currency in circulation in the western half of the empire.⁹⁴ The *denarius* circulated in the eastern half of the empire in much more limited quantities and alongside more common silver coinages, but it did circulate.⁹⁵ Therefore, the *denarius* created a vast monetary network covering the entire Roman Empire, even as it functioned differently in different parts: in the West it was the only currency available, while in the East it was a 'top currency' that was suitable for interregional transactions.⁹⁶ Conversion between *denarii* and *drachms* might have been eased by conventional exchange rates and, after Nero's reforms, greater similarity in the weight and fineness of the silver coinage, but conversion fees were never eliminated. Nevertheless, the existence of a monetary standard that could span the entire empire made coordination across great distances easier than it had been before.

The geographic spread of the *denarius* system was made possible by large-scale production of coins. While precise quantification is impossible, the evidence of die studies, the frequency of coins in hoards and as stray finds, and atmospheric pollution all point to very high levels of coin production in the Roman period.⁹⁷ Michael

⁹⁰ Woytek 2012, 315–316; 2014, 210.

⁹¹ Debernardi and Lippi 2019; Woytek 2012, 318.

⁹² Crawford (1970, 43) collects the evidence.

⁹³ Kemmers 2016.

⁹⁴ Von Reden 2010, 86–91; Kay 2014, 94–101 for the spread of the *denarius* in the Republican period. For the disappearance of local currencies in the West, see Burnett, Amandry, and Ripollès 1992, 18–19.

⁹⁵ Weaverdyck, vol. 1, ch. 7, 275–277 with further literature.

⁹⁶ For the terminology, see B. J. Cohen 2004, 14–16.

⁹⁷ For the difficulties involved with quantification, see Howgego 2009; de Callatay 2011; van Heesch 2011. For the complexity of the relationship between volume of coinage and money supply, see von Reden, vol. 1, ch. 8.C, 358–362.

Crawford estimated, based on die studies, that the volume of Roman silver coinage increased more than tenfold between the mid-second and mid-first centuries BCE to 450 million *denarii*.⁹⁸ Duncan-Jones estimated the volume of coinage (of all metals and including *drachms*) in circulation in the mid-second century CE at five billion *denarii*.⁹⁹ Although the absolute figures of the two estimates are not really comparable, taken at face value they suggest another tenfold increase in the money supply, this time over two centuries.¹⁰⁰ Republican silver continued to circulate well into the early Principate, and much of the later increase would have come in the form of gold coins, minted regularly for the first time under Julius Caesar.¹⁰¹ Gold might have constituted half to two-thirds of the value of coins in circulation, to judge from the coins found in Pompeii.¹⁰² This would suggest Roman coinage was well suited for the storage of wealth and large-scale transactions, though the risk of losing gold coins might have discouraged its transfer. Gold would also have been useful as security for loans, and thus facilitated large-scale credit transactions.¹⁰³

III.1.4 Credit and Banking

Money can only facilitate economic behavior if it is available. The large-scale production of coinage just described certainly helped in this regard, but physical limits on creating new coins and the difficulty of moving them in large quantities might have served as a break on economic activity.¹⁰⁴ Certain institutional configurations of credit and other forms of cashless payment ameliorated the problem by increasing the velocity of circulation and possibly by expanding the money supply. The quantitative extent to which they expanded the money supply remains open to question, but the combined forces of the institutional and social changes surrounding credit were key drivers in financial development. The expansion of credit systems from the Hellenistic period onward spurred the period's growing monetization, and shaped the development of interregional trade and connectivity.

⁹⁸ Crawford 1974 recently defended by Kay (2014, 89–93), who summarizes the critiques.

⁹⁹ Duncan-Jones 1994, 168–170 defended by Lo Cascio 2008, 162–163.

¹⁰⁰ This comparison is only meant to illustrate an order-of-magnitude increase. Crawford's figure ignores bronze coinage and the non-*denarius* silver coinage circulating in areas that were not yet part of the Roman Empire. Duncan-Jones considers the contribution of silver *drachms* and bronze to the overall money supply to be minimal, though, so the two estimates are not entirely incomparable.

¹⁰¹ Woytek 2014 for the introduction of gold coinage; Lo Cascio 2008 for the role of gold coinage in the economy.

¹⁰² Duncan-Jones 2003, but cf. Andreau 2008.

¹⁰³ Lo Cascio 2008.

¹⁰⁴ Though Verboven (2009) argues that the cost of moving and securing large amounts of money was relatively low.

In the Graeco-Roman world, lending at interest was a very common avenue of investment used by wealthy elites as well as institutions such as cities and temples. Indeed, a common form of benefaction was to establish a capital endowment that would be lent out and earn interest in order to pay for a certain service.¹⁰⁵ The prevalence of professional bankers and other intermediaries who would assess and absorb risk was crucial to this system.¹⁰⁶ The sophistication of law surrounding debt also supported the availability of credit by increasing the likelihood that creditors would be protected. Certainly, lending within social circles played a larger role than in modern credit markets,¹⁰⁷ but the practice of securitizing loans and the prevalence of financial professionals suggests that lending beyond one's immediate social circle was also common. Outside of occasional crises, credit was generally easy to come by.¹⁰⁸

The types of loans extended varied from basic to intricate. On the simple and often informal end of the spectrum, rural economies relied on devices like planting season loans, either in seed or in cash, which were repaid in kind with interest after harvest.¹⁰⁹ Indeed, tenancy and agricultural labor arrangements were undoubtedly the most widespread contexts for credit relationships.¹¹⁰ Advance payments for goods to be delivered later served a similar function of stimulating small-scale economic activity. More complex and formal loans, which were more likely to be documented in a written form, preserve a range of securitizations. Loans could be unsecured (*cheirographa*) or secured by a pledge (*parathekai*); they could take the form of mortgages or provisional sales, where the security came in the form of land, or of maritime loans, where the cargo itself was the security and where the creditors assumed the financial risk, or finally they could involve the purchase and sale of property (*homologiai*).¹¹¹

Maritime loans were particularly important in facilitating long-distance shipping.¹¹² These loans were made for a single voyage, and the due date was fixed for a certain period of time after the safe return of the ship, allowing the merchant to sell the cargo. Because the lender bore the risk of loss from 'acts of god' (shipwreck, piracy, etc.), interest rates were relatively high. Financiers could dictate the date by which a ship was to set sail, and interest rates might change based on the season of the voyage to reflect the increased risk of storms.¹¹³ The merchant bore the risk

105 Liu 2008; Hoyer 2018, 31–50.

106 Andreau 1999; Verboven 2020.

107 Verboven 2002.

108 For Roman credit crises, see Kay 2014, 235–265; 2018.

109 Kehoe 2007, 149–150.

110 von Reden 2007, 227.

111 For these categories, von Reden 2010, 99.

112 Rathbone 2003; De Romanis 2020, 159–208 for a discussion of maritime lending in the context of the Muziris Papyrus.

113 De Romanis 2020, 162–168.

of market fluctuations. If they did not expect to break even, they might dump the cargo or intentionally wreck their ship to avoid repaying the loan. As a consequence, lenders often sent a representative to monitor the merchant's behavior. Lenders with long-distance networks introduced some flexibility. In a second-century CE contract for a voyage from Beirut to Brindisi, the merchant has the option of buying a return cargo and repaying the loan in Beirut or paying the lender's agent in Brindisi.¹¹⁴ Indeed, lenders could mandate repayment in a distant port as a way of moving money.¹¹⁵ The maritime loan, then, not only financed commerce, but increased connectivity in other ways as well.

Although many of these forms of credit are attested in Classical Greece, the rules surrounding their use changed over time. For example, de Romanis has recently argued that the financier would also oversee the sale process and collect the revenue until the loan was repaid.¹¹⁶ In both Athens and Rome, moreover, only moveable property could be pledged as security in earlier periods, while by the late Republic in Rome, both houses and lands could be pledged, with the sphere of pledgeable assets increasing from there.¹¹⁷ These types of shifts, in general, widened access to credit. Similarly, Roman legal institutions evolved in response to banking practices.¹¹⁸ For example, we know from Plautus that bankers would make payments on behalf of their clients already in the early second century BCE.¹¹⁹ By the late second or early first century BCE, the obligation of the banker to pay out the money was legally enforceable, allowing absentee payments. Banking *societates* were distinguished from other partnerships in that every partner was bound by the actions of the others, both liable for and able to collect debts. In the early first century BCE, this was simply customary, but by the beginning of the third century CE, it was established law.¹²⁰ It also became possible to create a debt simply by recording it in an account, which allowed for cashless transactions.¹²¹

The financial practices of bankers and other specialists were critical to the functioning of the monetary economy in the ancient Mediterranean and southwestern Asia. Cashless transfers were certainly more convenient than coins for large transactions, although the introduction of the *aureus* ameliorated the physical problem to some extent.¹²² Cashless transfers also solved some of the problems of uneven coin supply. Fractional reserve banking, in which the banker only keeps a portion

114 *Digesta (Dig.)* 45. 1. 122. 1.

115 Rathbone 2003, 215–216.

116 De Romanis 2020, 174–179.

117 Von Reden 2010, 101.

118 Andreau 2020, 103–106; Rathbone and Temin 2008, 392–393; von Reden 2012, 282–283; Verboven 2020, 389–390.

119 Kay 2014, 116–124.

120 Andreau 2020, 105.

121 Rathbone and Temin 2008, 399–401.

122 Verboven 2009, 97–98.

of the money deposited with them on hand, lending out the rest at interest, increased the velocity of coinage circulation and even, in combination with cashless transactions, the overall money supply.¹²³ Physical pieces of metal always remained the foundation of the monetary economy. But formal and informal institutions developed that allowed monetary transactions to knit people together in more complex and geographically extensive relationships than would have been possible with coinage alone.

III.2 The Role of the State

In the ancient Mediterranean and the Near East, the most prevalent form of money, coinage, was inextricably associated with the state.¹²⁴ The minting of coins was a right exclusive to, and partly constitutive of, a political organization. But money requires users as well. Any benefit that might accrue to a state from producing coinage depended on the coinage's ability to circulate, that is, its acceptability. Money is both an institution-as-rule – the result of negotiated decision making – and an institution-as-practice – the spontaneous result of repeated behavior.¹²⁵ Von Reden has shown how the Ptolemaic state, in order to monetize parts of the Egyptian economy, established a range of institutions in addition to coinage that were designed to affect the behavior of the populace in such a way as to make the state's coinage acceptable.¹²⁶ This benefited the state fiscally, but it also benefited members of the state commercially. Indeed, to draw a sharp distinction between the fiscal interests of the state per se and the commercial interests of the actors embodying and operating within state institutions is anachronistic.¹²⁷ Here we discuss the various reasons states might have minted coinage before examining the broader social context in which members of the state were acting.

As noted earlier, it has long been thought states minted coinage to cover their own expenses, primarily military expenditure.¹²⁸ In some cases, a clear link between military and monetary activity is evident. The *denarius* system was introduced in the context of the Punic war, as we have seen. Mithridates VI of Pontus minted

123 Kay 2014, 110–113; Verboven 2020, 386–387. William Harris has argued that transferable debts acted as monetary instruments that increased the money supply in the Late Republic and Principate (2006; 2008; 2019). Verboven (2020), however, argues that the transferability of debt was limited, and written debt notices were not monetary instruments.

124 In contrast to the situation in South Asia and China (Dwivedi, ch. 14 and Leese-Messing, ch. 15, this volume).

125 Gómez 2019.

126 Von Reden 2007.

127 Von Reden 2010.

128 Crawford 1970. For a historiographic discussion, see Butcher 2018. For a survey of state expenses that might have occasioned coin minting, see Howgego 1990.

coins on a large scale to pay his troops in the late second and early first centuries BCE.¹²⁹ The belligerents in the civil wars of Late Republican Rome produced large volumes of *denarii* all over the empire, contributing to the expansion of the *denarius* system.¹³⁰ However, archaeological and numismatic evidence show that military expenditure cannot be the sole reason for coin production. In the Roman case, for example, the distribution of coins is not well-correlated with military bases, and the rhythm of production is not tied to military campaigns.¹³¹ Other explanations must be sought.

The profit motive of the state might go some way to explaining coin production. By establishing a value for a coin that exceeds the intrinsic value of the precious metal it contains, states can profit from minting. Episodes of coinage debasement are often explained as a response to states' financial straits.¹³² Coinage also made the collection of taxes easier, and thus reduced transaction costs for the state itself. The denominations of some coins were chosen to facilitate the payment of certain taxes.¹³³ In order for the state to extract taxes in coin, it had to support a monetary system by issuing small change, even if it was ultimately interested in the larger denominations.¹³⁴ Nero's reforms have been explained as an effort to bring the *denarius* and *drachm* into closer alignment in order to simplify the collection of taxes.¹³⁵ Both the provision of small change and the greater correlation between the *denarius* and the *drachm* would have facilitated economic coordination, regardless of their motives.

The ideological and political functions of coins also played a role in their durability. The ability of a coin to bear an image and legend that would circulate between people made it an excellent medium for mass communication. Roman emperors used coins to advertise their virtues.¹³⁶ Indeed, having one's name on a coin was partly constitutive of one's status as emperor.¹³⁷ Civic symbols on coins contributed to the establishment of political communities in archaic Greece,¹³⁸ and civic coinage was one of the media through which cities of the Eastern Mediterranean asserted their identity in the Hellenistic and Roman periods.¹³⁹ The ability of coin-

129 De Callatay 1997.

130 Butcher and Woytek 2018.

131 Distribution: Hoyer 2018, 64 on North Africa; Katsari 2008 on the frontier provinces in general. Rhythm: Butcher 2004, 245–251 on Syrian provincial and civic issues. See Woytek 2018, 16–17 for further literature.

132 And were sometimes recognized as such even in antiquity, see Pseudo-Aristotle *Oikonomika* (Arist. [Oec.]) 2. 1349b.

133 Howgego 1990, 23.

134 Butcher 2018, 168.

135 Butcher et al. 2014, 201–238; Butcher 2018, 174–175.

136 See Noreña 2011 for Roman emperors' ideological use of coins.

137 Howgego 1990, 21.

138 Von Reden 2010, 24–25.

139 Duyrat 2016, 394–399; Howgego, Heuchert, and Burnett 2005.

age to express political power probably explains why, after introducing the *denarius*, the Romans eliminated all other Italian silver coins from circulation.¹⁴⁰ In the late second or early third century CE, Cassius Dio associated such monopolization of coinage with autocracy when, in a fictional debate about whether Augustus should institute a monarchy, he had the pro-monarchy disputant advise: “None of the cities should be allowed to have its own separate coinage or system of weights and measures; they should all be required to use ours.”¹⁴¹

But for coinage to successfully communicate messages, generate profits for the minting authority, or discharge state debts, it had to circulate: it had to be accepted by users. One could see coinage as an object of negotiation between the state, which valued coinage for the reasons listed above, and the populace, which valued coinage for its monetary functions. In this framing, the object of debate is whether or not ancient states understood or considered the populace’s need for an efficient medium of exchange in their coinage policies.¹⁴²

However, the dichotomy is misleading in two ways. First, ancient states often had commercial interests that were qualitatively similar to those of private individuals. Hellenistic kings and Roman emperors both owned property on a large scale, and revenue-in-kind often had to be monetized via the market. Second, states were coalitions of actors, most of which were privately wealthy and engaged in the same kinds of activity as the rest of the populace. Indeed, Seth Bernard has recently argued that the production of pre-*denarius* Roman coinage should be seen in the context of sociopolitical negotiation and changes in the coalition of state power holders.¹⁴³ He connects historically attested conflicts between different social orders and an increase in private wealth derived from conquest to early coinages minted in a variety of denominations, often small. At the risk of simplification, the Roman state minted coins that functioned well for commercial exchange because people whose wealth depended more on commercial exchange (elites engaged in commercial agriculture and moneylending) were in the process of taking over the state.

In competitive aristocracies like Republican Rome and most of the cities of the empire, the money-using populace could pressure powerholders to take some concern for the money supply.¹⁴⁴ But even imperial states included coalitions that depended on a functioning monetary system for their well-being. Soldiers whose sala-

¹⁴⁰ Woytek 2014, 212.

¹⁴¹ Cass. Dio 52. 30. 9 trans. Cary. See below for the lack of standardization of weights and measures in the Roman Empire.

¹⁴² Butcher 2018 provides a recent overview of the debate.

¹⁴³ Bernard 2018.

¹⁴⁴ See the example of the praetor Gratidianus, whose edict in 85 BCE stabilizing the currency won him great honor (discussed by Crawford 1970, 42; Howgego 1990, 23). Butcher (2004, 146) argues that city councils would have been more responsive to local public pressure than imperial governments.

ries were worthless were dangerous.¹⁴⁵ The emperor Diocletian explicitly cites the penury of his soldiers in his attempts to stabilize the monetary system in the late third/early fourth century CE.¹⁴⁶ We should also remember that the wealth of the aristocracy was based, in large part, on commercial agriculture and moneylending. A steady supply of stable money was in their interest as well. A lack of interest by the state in the money supply seems reasonable when the state is an abstract concept. When it is dissolved into its constituencies, such disinterest appears less likely.

IV Physical Infrastructure

As with fiscal regimes and monetization, large-scale physical infrastructure also entailed negotiation between imperial states and their various constituents.¹⁴⁷ The construction of major infrastructural works required a scale of investment that surpassed the capabilities of any private individual and therefore entailed communal action. Local communities and individuals always played a central role, but the capacity and willingness of the state or state-based actors to invest was a crucial factor in the development of truly large-scale infrastructure.

The willingness of imperial states to invest in infrastructure stemmed from a particular ideology of rule. In the ancient Mediterranean, massive building works were a testament not only to power – the ability to muster the resources and knowledge to overcome nature – but to beneficence as well. Both Hellenistic kings and Roman emperors were expected to be generous, but in the Roman period, there seems to have been a particular emphasis on the utility of monumental construction.¹⁴⁸ Dionysios of Halikarnassos, a Greek living in Rome in the Augustan period, emphasized the utility and expense of infrastructure to illustrate the power of Rome:

In my opinion the three most magnificent works of Rome, in which the greatness of her empire is best seen, are the aqueducts, the paved roads and the construction of the sewers. I say this with respect not only to the usefulness of the work ... but also to the magnitude of the cost.¹⁴⁹

Frontinus, writing about aqueducts, draws an explicit comparison with “the idle pyramids or the useless, though famous, works of the Greeks.”¹⁵⁰

145 Hoyer (2018, 63–75) emphasizes the need for a well functioning monetary system to give soldiers’ salaries value.

146 The statement comes from Diocletian’s edict on maximum prices, but this was part of a larger effort at currency and tax reform (Corbier 2005).

147 For the definition of ‘infrastructure’ in regards to the ancient economy, see Woytek 2018. For the infrastructure as space where various interests intersected, see Kolb 2014, 12.

148 Kolb 2014, 9–12; Schneider 2014; Woytek 2018, 11–13.

149 Dionysios of Halikarnassos 3. 67 trans. Cary.

150 Frontinus *De aquae ductu urbis Romae* (Frontin. *Aq.*) 16, trans. Bennett.

While the civic ideological background of the Roman emperor might have encouraged infrastructural investment, the contrast with Hellenistic kings should not be overstated. As always, ideology is not a simple reflection of reality, and most of the emperors' investments were centered on the city of Rome and Italy. Nor were the Hellenistic kings idle in this area. City foundations necessarily required a major investment in physical infrastructure.¹⁵¹ Seleukos I Nikator's creation of Seleukeia-Tigris in Mesopotamia and Laodikeia and Seleukeia-Pieria in the northern Levant required the construction of large artificial harbors,¹⁵² to say nothing of the extensive harbor complex of Alexandria. Beyond city foundations, the Ptolemies invested heavily in transportation infrastructure linking the Nile with the Red Sea, and we hear of at least one occasion on which an Attalid king built harbor works at Ephesus.¹⁵³

Nevertheless, at a general level, the ideological difference between Hellenistic kings – whose position was based primarily on military supremacy – and Roman emperors – who relied on a combination of military success and other, more civic virtues – was real.¹⁵⁴ In addition, the Roman Empire at its height exceeded the size of any Hellenistic Empire, so Roman emperors had a much larger resource base to draw on. Of course, the scope of potential infrastructural investment was correspondingly larger. These ideological and political factors, in combination with the technological development of Roman concrete (see sec. VII.2 below), resulted in the construction of more physical infrastructure under the Roman Empire than ever before.

The types of infrastructure discussed here all facilitated activities that were particularly important for and characteristic of the economies of the ancient Mediterranean and southwestern Asia: irrigation systems and aqueducts increased agricultural production and urbanism, and the proliferation and development of harbors enhanced the natural connectivity of the Mediterranean and contributed to its maritime integration. We pass over roads in this section as Roman roads were discussed in volume one.¹⁵⁵ Less is known about Hellenistic roads, though the Ptolemies built significant road infrastructure including forts and watering stations in Egypt's Eastern Desert,¹⁵⁶ and the Seleukids built and maintained certain royal roads in their empire, distributing colonies, forts, and milestones along them.¹⁵⁷

151 For Hellenistic city foundation, see von Reden, vol. 1, ch. 1, 35–39.

152 Kosmin 2014, 187–189.

153 J. P. Cooper 2009; Sidebotham 2011, 179–182 (canal); Strabo 14. 1. 24 (Ephesus).

154 Arnaud (2014) distinguishes the benefactions expected of Hellenistic and Roman rulers and elites from the care for subjects expected of the Roman Emperor in the context of harbor construction. For a comparison of Hellenistic and Roman monarchical ideals, see Noreña 2011, 37–100, 314–316.

155 Weaverdyck, vol. 1, ch. 7, 271–274.

156 Sidebotham, Hense, and Nouwens 2008; Sidebotham and Gates-Foster 2019; Sidebotham 2011, 28–31.

157 Kosmin 2014, 142–169.

IV.1 Hydraulic Infrastructure

Control of water has long been associated with power. Of Dionysios's "three most magnificent works," two concern the strategic movement of water. In modern scholarship, Wittfogel's theory of Oriental Despotism has spawned much discussion of the centralized control of ancient water regimes – particularly in arid regions of southwestern Asia.¹⁵⁸ Scholars now envision a more complex relationship between imperial power and water supply systems, with multiple, varying configurations of control and funding at work.¹⁵⁹ Although imperial planning and financing facilitated the construction of large-scale and expensive projects like aqueducts, the management of these infrastructural systems was never exclusively imperial or even public.

The physical infrastructure involved in the management of water resources in the Hellenistic and Roman worlds can be loosely divided into two categories: urban water distribution systems that allowed larger populations to dwell in close quarters;¹⁶⁰ and agricultural irrigation programs that increased the extent of arable land, crop yields, and the variety of crops that could be grown.¹⁶¹ The scale of hydraulic infrastructure projects varied greatly, ranging from constructions that served individual households to dramatic regional interventions that transformed vast landscapes.

IV.1.1 Urban Water Management

The provisioning of cities with water was a central requirement for urban growth and had thus been a concern for urban authorities long before the Hellenistic period. The construction of aqueducts to serve Greek cities is attested already in the Archaic period, with several large projects associated with early *polis* rulers.¹⁶² Despite this, the broader system of urban water management in the early Greek cities was not centralized. Instead, private citizens were encouraged to construct their own wells if they lived too far away from a public water source, and were entitled to draw water from the private wells of their neighbors if their own territory yielded no

158 On Egypt, see Monson 2012, 36–45. On the association between controlling water and controlling the Roman Empire, see Purcell 1996.

159 E.g., Wilkinson and Rayne 2010, 117.

160 See for example the case of Gadara discussed in Keilholz 2017, where aqueduct construction can be closely tied to periods of urban growth.

161 An older perception that urban water distribution systems were entirely independent from agricultural hydraulic infrastructure has been widely challenged in recent years, see, e.g., Gazenbeek and Jansen 2000.

162 Koutsoyiannis et al. 2008.

water.¹⁶³ Although technological developments that began in the Hellenistic period and reached their fulfillment under the Roman Empire enlarged the scale and improved the effectiveness of public urban water supply systems, private water management installations remained important throughout the Roman period.¹⁶⁴

Nevertheless, the prowess of Roman engineering created the ability to move higher volumes of water across more rugged terrain. Accounts of early Roman aqueduct construction report that the funding for these ambitious projects, running in some cases hundreds of kilometers, came directly from war booty, reflecting the exceptional nature of the expense.¹⁶⁵ By the time of the Principate, the costs associated with aqueduct construction were borne by contributions in variable amounts from the emperor, local communities, and private donations or tax levies.¹⁶⁶ Although private *euergetism* played an important role in this financing, the cost of construction was generally prohibitive for any single individual on his own, although in North Africa, a number of aqueducts were financed by a single benefactor.¹⁶⁷

The costs associated with aqueducts did not end with their construction. Keeping water running freely required ongoing maintenance. In the exceptional case of the city of Rome's own aqueducts, much of the cost of protecting and maintaining the water supply system was assumed by the emperor himself and paid for by the imperial fisc.¹⁶⁸ Elsewhere, these maintenance costs were either paid for by water use fees or assumed by local city officials or even private individuals. Though rarely recorded, we hear of *agoranomoi* in Greece charged with oversight of water infrastructure, and in Spain a town council mandated that the chief magistrates restore an aqueduct.¹⁶⁹

IV.1.2 Agricultural Hydrological Infrastructure

Owing to climatic conditions, the nature of agricultural hydrological infrastructure in the Mediterranean basin and southwestern Asia differed – as has the history of scholarship about water in the two regions. In the case of the Mediterranean, where rain-fed agriculture was generally possible, irrigation infrastructure has received little attention. Recent work, however, has highlighted the interconnected nature of urban and rural water distribution systems – pointing out, for example, that many aque-

163 Plutarch *Solon* 23.

164 E.g., in Greece, Yannopoulos et al. 2017, 1025–1029.

165 Frontin. *Aq.* 6

166 On this general combination of financing sources for aqueduct construction, see Leveau 2001, 85–86.

167 E.g., *IRT* 117 from Sabratha. See also *IGR* 3. 804 for a donation of 2 million *denarii* to fund aqueduct construction at Aspendos in Pamphylia.

168 R. M. Taylor 2000, 85–86.

169 Greece: *IG* 5. 1. 1390 ll. 103–105 (Lolos 1997, 296–297). Spain: *CIL* 2. 3541 (Goffaux 2001, 267).

ducts also featured rural distribution channels, opening up the possibility that these projects were not serving only ‘parasitic’ cities, but rather both urban and rural landscapes.¹⁷⁰ More broadly, there has been increasing attention to the question of whether investment in irrigation technology was, in fact, a more significant factor than has been previously assumed – and one with explicitly economic implications. Even in Italian villa agriculture, irrigation was used to water meadows and market gardens.¹⁷¹

In contrast, in Egypt and Mesopotamia where aggressive water management is necessary for agricultural success, Hellenistic monarchs and their Roman successors inherited hydraulic systems that had been functioning for, in some cases, millennia, and discussions of the management of these systems have played a central role in economic history. Evidence from the Ptolemaic, Seleukid, and Roman contexts demonstrates the extension and expansion of these older frameworks, as well as the expansion of some new technologies.¹⁷² Research on hydrological control in southern Syria provides an example of how the various systems interacted, demonstrating that village-based water management systems, based on preexisting practices, remained largely stable during both the Hellenistic and Roman periods, even as urban supply systems were undergoing significant developments.¹⁷³ This is not to say that the rural landscape of arid regions remained unchanged, only that previous systems of water management were often durable. It is clear, meanwhile, that the cultivation of crops like olive trees and grapes in North Africa was bolstered by the expansion of irrigation at small and large scales, bringing new economic potentials to these regions.¹⁷⁴

One of the clearest examples of the involvement of Hellenistic monarchs in hydraulic management relates to the Ptolemaic land reclamation project in the Fayum depression of Egypt, which began in the late 260s BCE. The Fayum project developed vast new tracts of productive land through the creation of drainage systems and irrigation channels. In Egypt, where ecological factors limited the possibilities for agricultural intensification, this expansion resulted in a dramatic increase in cultivatable land, with the eventual project estimated to have represented between five and seven percent of all of the cultivable land in Egypt.¹⁷⁵ These reclaimed lands were under the political control of the king, and enabled the monarchs to capture additional revenue from rents, as well as secure political power through land grants to loyal followers.¹⁷⁶ The new land was initially used to settle Macedonian soldiers, with other Greeks and Egyptians also eventually moving to the territory as well.

170 These have long been considered to be illegal channels, but opinion on this matter has begun to shift, seeing rural distribution as a widespread feature of aqueduct projects, and likely one that was at the very least tolerated by imperial authorities, or perhaps was even intentional (Kamash 2012).

171 Ronin 2020.

172 On the uneven adoption of hydraulic practices in the Roman Near East, see Kamash 2013.

173 Braemer et al. 2009.

174 Ronin 2020.

175 For the figures of arable land and its carrying capacity, see Manning 2003, 107, n. 49.

176 On the direct control of land, see discussion in Manning 2003, 104.

Papyrological records relating to the activities of two directors of hydraulic projects in the Fayum, Kleon and Theodoros, offer detailed evidence for both imperial interest in and oversight of the hydrological works.¹⁷⁷ One specific project is detailed in the papyrological sources: the draining of the land that would become the Zenon Estate. This example demonstrates that vast projects were accomplished by Ptolemaic authorities and ambitious local individuals working in concert. In this case, the tools used in the project seem to have been owned by a central authority, who lent them out and also helped with procuring laborers, who were then paid out of private funds.¹⁷⁸

As expensive as the original work of land reclamation was, the sustained maintenance required for many types of early hydraulic systems presented an ongoing challenge. Many of the officials involved in the planning of major hydrological works – individuals associated with the central government – were also directly involved in later efforts to maintain the reclaimed land and make it fruitful through experimentation with different crops, suggesting a sustained state interest in the success of the reclamation projects.¹⁷⁹ Moving forward in time, in Roman Egypt, documents called *penthemeros* certificates evince a system of mandatory labor, whereby residents of the Fayum were required to provide five days a year working on the irrigation systems. At first interpreted as a Roman innovation that demonstrated the deep reach of Alexandrian authority into the Egyptian countryside, more recent work has hypothesized that this system was not a new invention on the part of the Romans, but rather an example of how Roman power came to coordinate labor regimes that had been arranged informally in prior periods.¹⁸⁰

The infrastructure of agricultural water management, then, is characterized by some large-scale imperial interventions, but these could only be maintained by local societies, and in some cases, imperial intervention had very little impact. Imperial influence is more evident in the construction of aqueducts that facilitated the growth of cities and therefore, indirectly, all of the consumption and other economic behavior attendant on urbanism.

IV.2 Transportation Infrastructure: The Case of Harbors

Developments in transportation infrastructure ameliorated the friction of distance, easing the transportation of both goods and information. Here, we focus on harbors and canals, which enhanced the natural connectivity of the Mediterranean.¹⁸¹ Key

¹⁷⁷ On the role of the state in these works, see Haug 2017.

¹⁷⁸ See, e.g., discussions in D. J. Thompson 1999, 135; Manning 2003, 107.

¹⁷⁹ D. J. Thompson 1999, 134–137.

¹⁸⁰ For new approaches, see, e.g., Haug 2017, 6. For traditional interpretations, Sijpesteijn 1964, 4–5.

¹⁸¹ Harbors and canals were often integrated into complex riparian infrastructural systems. The best documented is that at Rome's imperial port, Portus, for which, see Keay 2018.

developments in our period are the increased size of the largest harbors and the proliferation of harbor infrastructure made possible by the discovery of hydraulic concrete (sec. VII.2, below). Building and maintaining this infrastructure required a complex interplay of imperial, civic, and private actors.

Imperial power led to the creation and elaboration of ports to support its own survival. The Seleukid colonial foundations in the northern Levant have already been mentioned, and Herodes's construction of the great port Sebastos supplying his new foundation, Caesarea Maritima in the southern Levant at the end of the first century BCE should be seen in a similar light.¹⁸² Most important for Afro-Eurasian exchange are the Red Sea ports built by the Ptolemies, above all, Ptolemy II. Berenike and Myos Hormos were the busiest, standing at the head of overland routes to Koptos on the Nile.¹⁸³ Berenike in particular was the main port for the massive pepper carriers that rode the monsoons from Southern India in the Roman period. The northernmost port, Arsinoe (under the Romans renamed Clysma), was located at the northwest tip of the Red Sea and connected to the Nile by a canal, also built by Ptolemy II.¹⁸⁴ The initial impetus for this large-scale infrastructural investment was fiscal and military: the Ptolemies needed war elephants to counter the Indian elephants of the Seleukids, and they could offset the cost by exploiting gold mines in the Eastern Desert and by selling elephant and hippo ivory.¹⁸⁵ The effect of this infrastructure, though, was to create nodes connecting the Red Sea to the Nile, and thus the Mediterranean to the Indian Ocean much more directly than ever before.

Imperial harbors also changed connectivity within the Mediterranean. When Alexander the Great founded Alexandria at the end of the fourth century, he created the largest harbor system the Mediterranean had ever seen and connected the Nile to the Mediterranean in a new way.¹⁸⁶ Alexandria was founded by combining the populations of several smaller ports that had been situated on different branches of the delta.¹⁸⁷ The new harbor was massive. It consisted of two basins separated by a 1.3 km long mole, the 'heptastadion.' The eastern basin alone covered over 226 ha with over 12 km of quays.¹⁸⁸ For comparison, the main 'Kantharos' basin in Classical Athens's harbor, Piraeus, was only 75 ha. The famous 'lighthouse of Alexandria,'

182 Raban et al. 2009.

183 De Romanis 2020, 46–54; Cobb 2018b, 52–59 for overviews.

184 Sidebotham 2011, 178–182 for Arsinoe/Clysma and the canal. The function of the canal is much debated and may have changed over time. Dug first under Darius I, it silted up and was reopened several times under Ptolemy II and then Trajan in the second century CE. J. P. Cooper 2009 for a longue durée history of the canal; Aubert 2015 and De Romanis 2020, 35–46 for contrasting views of its commercial importance. For other Red Sea harbors, Sidebotham 2011, 175–189.

185 Sidebotham 2011, 39–53; Cobb 2018b, 28–60.

186 Empereur 1998; Goddio 1998; Goddio et al. 2008; Evelpidou et al. 2019. Khalil 2017 provides a historical overview of Alexandria from a maritime perspective.

187 Empereur 2018.

188 Wilson, Schörle, and Rice 2012, 384.

built in the early third century BCE, was 130 m tall and was visible from several kilometers away. This colossal scale was simultaneously a political assertion of power by Alexander and the Ptolemies, a military necessity for maintaining the Ptolemaic navy, and a method of concentrating traffic between the Nile and the Mediterranean that made it easier to exploit fiscally.

The size of Alexandria would also have had broader economic impacts. The new harbor infrastructure could handle larger ships, making the export of Egyptian grain more efficient, and it centralized the location of exchange, facilitating information exchange about goods and trading partners, thus lowering transaction costs. In the early Roman period, Alexandria's connection to the Nile was further enhanced by the elaboration of harbor infrastructure on Lake Mareotis.¹⁸⁹ This was part of a larger project of infrastructural investment to ease the shipment of Egyptian grain to Rome, but it would also have affected the movement of goods coming from the Indian Ocean.

The construction of Rome's imperial harbor might have had similar effects. The mouth of the Tiber, on which Rome sits, did not provide a naturally deep, protected harbor. For centuries, the main deepwater port of Rome was Puteoli, 200 km to the south, where bulk cargoes would be transshipped into smaller vessels that would sail along the coast to Ostia at the Tiber's mouth. In the mid-first century CE, the emperor Claudius built a large, artificial harbor just north of Ostia, and at the beginning of the second century CE, Trajan expanded the facilities with an elaborate, internal harbor.¹⁹⁰ The entire port system covered over 233 ha and provided up to 13.89 km of quay space.¹⁹¹ This system of harbors and canals not only fed the city, it made Rome the center of a Mediterranean-wide market in bulk products that might have stimulated the construction of other ports capable of handling the large cargoes demanded by Rome.¹⁹² Indeed, Portus and Alexandria could be seen as occupying central places in a hierarchical system of interconnected ports.¹⁹³ If the existence of megaports helped integrate regional port systems, two megaports connected through regular bulk shipments of grain and other products would have helped connect not only the Eastern and Western Mediterranean, but the continental and oceanic hinterlands beyond.

The construction of these megaports was a result of imperial, political forces. The Seleukid ports mentioned above were similarly imperial initiatives that increased connectivity between the Mediterranean and northern Mesopotamia on the one hand, and between Mesopotamia and the Indian Ocean on the other. These imperial harbors, however, were exceptional. Most of the port network consisted of

¹⁸⁹ Flaux et al. 2017

¹⁹⁰ Keay 2018 with further literature.

¹⁹¹ Keay 2018, 150.

¹⁹² Keay 2016; 2018.

¹⁹³ For port hierarchies, see Wilson, Schörle, and Rice 2012 with further citations.

smaller harbors, with infrastructure funded more from local sources, usually a mix of public funds and private beneficence.¹⁹⁴ The construction of large, new harbors was considered the purview of royalty, but maintenance, renovation, embellishments, and the construction of discrete elements within the harbor were all funded locally.¹⁹⁵ The harbor of Ephesos, as the most important port on the west coast of Asia Minor, received direct imperial benefactions several times over the course of its history, but even here local funding was critical.¹⁹⁶ In the early second century, before Hadrian redirected a river that was pouring silt into the harbor, epigraphic evidence records donations by local and provincial elites for “construction work on the harbor.”¹⁹⁷ The sums, while significant, are in line with the customary donations of elites to other projects and would not have covered the construction of major new infrastructure.¹⁹⁸ On the other hand, these could have been the largest contributions in a public subscription to raise funds.¹⁹⁹ In any case, while normal costs of operating the harbor would have been funded from the public treasury, extraordinary maintenance work and embellishment required private contributions. Imperial power may have created the largest, most central nodes in the Mediterranean harbor network, and occasionally intervened in some of the second-tier harbors like Ephesos, but the vast majority of the network relied on civic institutions.

V Law

A universal legal system is often cited as one of the major economic benefits of empire.²⁰⁰ According to NIE theory, a consistent set of rules (‘formal institutions’) enforced by a third party lowers negotiation and enforcement costs, thus facilitating economic coordination.²⁰¹ Serious uncertainties remain, however, in applying this theory to the ancient world. Most prominently, at no time in the period under con-

194 Arnaud 2016 for the importance of cities in maritime trade networks.

195 Arnaud 2014, 167–169.

196 See Kokkinia 2014 for the entanglement of private, civic, provincial, and imperial in Ephesian harbor construction and regulation. See also, more generally, Arnaud 2014; 2015; 2016.

197 Kokkinia 2014, 184.

198 Arnaud 2015, 66 and 76 n. 43.

199 Such a system is alluded to by Dio Chrysostom, a second-century CE orator from Prusa in Anatolia (*Orations* [Dio Chrys. *Or.*] 40. 5–12; 45. 12–16; 47). Dio had proposed some sort of public building. At first, the citizens of Prusa not only approved of his proposal, but agreed to contribute to it (45. 16). He also secured the support of the governor (40. 6). But as the work progressed, he had to repeatedly defend the project and himself from accusations by political opponents and people unhappy with changes to the urban topography.

200 E.g., Manning 2005; Lo Cascio 2007.

201 North 1990, 46–53 and von Reden, ch. 2, II.4, this volume.

sideration was there a single, universally valid system of law.²⁰² If a plurality of legal systems undercuts the function of law in providing predictability, so too will a lack of consistency within a single legal system. We must also question the practical efficacy of legal systems in shaping behavior. We cannot take for granted the idea that everyone had access to impartial adjudication of conflicts, nor that judicial decisions were actually enforced. In addition to the general characteristics of the legal landscape, the form of particular legal institutions shapes economic behavior. Here we discuss property rights, which affect the distribution of wealth and shape incentives for investment, contracts, focusing on the cost of crafting enforceable agreements, and agency, which influences how people create economic organizations.²⁰³

V.1 The Consistency of Law

V.1.1 The Hellenistic Legal System(s)

To speak of a Hellenistic ‘legal system’ is misleading: there never existed a legal system united in either name or practice across Hellenistic space, and even within specific political contexts, legal pluralism was the norm. There were a range of divergent legal frameworks that were in use (e.g., those based on Greek or Aramaic traditions). Moreover, since the Hellenistic kingdoms sat atop numerous smaller-scale political units, each with a legal system of their own,²⁰⁴ the critical functions of both lawmaking and adjudication were, as a rule, dispersed between both state and nonstate legal orders, such as temples and guilds. Kings had law-giving and jurisprudential rights that they could exercise across their domains, but the frequency with which these imperial legal rights were exercised and the scope of contexts within which they were deployed varied considerably.²⁰⁵

Local law derived authority from a variety of institutional structures ranging from *poleis* to temples, and it applied to members of a range of social collectives,

202 This was true even after the *constitutio Antoniniana* of 212 CE made Roman citizenship universal (Humfress 2013b; Tuori 2007).

203 Numerous other areas of law also have economic consequences but cannot be treated here. For a survey of Roman law and economics, see Dari-Mattiacci and Kehoe 2020. A collection of contributions addressing law and transaction costs from the ancient world in general, see Kehoe, Ratzan, and Yiftach 2015a.

204 Von Reden, ch. 12.A, this volume.

205 O’Neil suggests that, when Alexander interfered directly in local legal practice, “he was careful to show that he did so in the general interest, preserving the basic principles of higher justice” (2000, 425). For a contrasting opinion that sees a greater degree of interaction between local and imperial systems in the case of the Attalids, see Kantor 2014. On the Ptolemaic system, see recently Keenan, Manning, and Yiftach-Firanko 2014, esp. 17–20 for a brief overview.

including most often citizen bodies but also communities based on *ethne* like the Jews. Naming only a few of the largest and best documented legal traditions in the Hellenistic Near East and Egypt, we find a body of Demotic law in Egypt; Jewish law rooted in the Temple in the Levant; Babylonian traditions, which included both cuneiform and Aramaic practices in Mesopotamia; and civic law embedded in Greek institutions across the territory.²⁰⁶ Whatever the potential for imperial intervention, it is clear that economic activity was conducted within a space of interacting spheres of legal authority – neither fully independent nor entirely centrally directed.

The details of how several legal traditions were operationalized in a system of complex, overlapping spheres of legal authority are most visible to us in Egypt. An Egyptian sphere is attested by the Hermopolis Legal Code, a Demotic codex found in a temple archive dated to the early third century BCE that provides formulae for various types of legal cases.²⁰⁷ These formulae would have been used by the *laokritai*, or panels of judges who adjudicated cases based on Egyptian law, largely (or entirely?) among Egyptian speakers. The *laokritai* system is believed to predate the Ptolemaic period by several centuries, and much of the legal logic of the Hermopolis Code reflects earlier Egyptian legal practices.²⁰⁸

Other courts were innovations of the Ptolemaic period, and the entire structure underwent transformations over the course of centuries, with Ptolemy II credited with systematizing parallel Greek and Egyptian systems.²⁰⁹ Greeks, and eventually Greek speakers, had their own courts, first the *dikasteria*, which functioned at the *nome* level. There was also the *chrematistai*, a royal judicial panel that also heard cases in Greek, as well as the more obscure *koinodikion* ('common court') that emerged in the third century BCE, likely involving both Greek and Egyptian jurists. To this, one can also add legal tradition that applied to Jewish residents, the Septuagint translation of the Torah, which came to act as civic law for the community.²¹⁰ The Greek courts did not function according to an overarching law code, but instead followed royal pronouncements (*diagrammata*) or local civic codes (*politikoi nomoi*), where they were present.²¹¹ By the late second century BCE, it was not the ethnicity of the participants that determined the venue, but instead the language of the contract in question.²¹² Beyond the state courts already mentioned, associations also exercised a certain type of legal authority, requiring their members to adjudicate conflicts within the association structure rather than the court system.²¹³ Judicial

²⁰⁶ For an overview, Geller, Maehler, and Lewis 1995.

²⁰⁷ Donker van Heel 1991.

²⁰⁸ Allam 1991, 118.

²⁰⁹ Wolff 1962, 56–58.

²¹⁰ For a recent introduction, see Manning in Keenan, Manning, and Yiftacht-Firanko 2014, 17–19. On the overlapping spheres of private law, Yiftacht and Vandorpe 2019. See also Wolff 1960.

²¹¹ Lippert 2012, 9.

²¹² *P. Tebt.* I 51. 207–220.

²¹³ Lippert 2012 cites *P. Lille* 29 l. 23, *P. Cairo CG* 30606 l. 18.

proceedings were attended by an official named in both Greek and Demotic texts as the *eisagogeus*, a functionary from the central government who acted as a liaison with local courts, and who worked with a bailiff to ensure that the court's determination was carried out.²¹⁴ The jurisdictional authority of these various courts was complicated. Petitions were made to the Greek administrator of a *nome*, the *strategos*, to hear a case, who decided which court it should be heard in – referring the matter either to one of the courts named above, or in the case of issues involving taxes, directly to financial administrators.²¹⁵

This distribution of legal authority demonstrates how, even in the face of considerable pluralism and the absence of a centralized legal system, the court systems did offer a more capacious range of possibilities for enforcement and adjudication across and between various social groups and communities within Egypt. The general trend, furthermore, was one toward an increasingly streamlined process, with the *chrematistai* eventually becoming the sole venue for Greek-language disputes and even encroaching into the territory of the *laokritai*. The documents surrounding a single property dispute case, brought to the *strategos* of Thebais in 117 BCE, however, demonstrate that litigants before a Greek court mustered arguments based on both Greek and Egyptian legal language, demonstrating the long-lasting complexity of the underlying system.²¹⁶

Evidence from Hellenistic Babylonia, and particularly from the cities of Uruk and Babylon, hints at similar ranges of both adjudication and enforcement mechanisms, with both temple and civil courts.²¹⁷ Archaeological factors, however, complicate the interpretation of legal evidence from this sphere. According to cuneiform evidence, legal documents produced in the temple context could be written on either leather or clay tablets, with different scribes responsible for each type of text: the *tupšarru* for clay tablets written in cuneiform, or the *sepīru* for leather documents written in Aramaic and possibly also Greek.²¹⁸ The choice between the two media (and therefore languages) was not a binary one. There are instances where it is clear that a single contract was recorded in both ways, although only the cuneiform version has survived.²¹⁹ Although our evidence for legal practice in Babylon comes from clay tablets, Clancier has argued that we ought to imagine that leather documents would have actually formed the backbone of the civil justice system, with clay copies in cuneiform produced explicitly for use within temple contexts.²²⁰ In cases where temple affairs involved individuals from these wider circles, then,

²¹⁴ Allam (2008) believes that the duties of the *eisagogeus* represent a development of the responsibilities of scribes in the pre-Ptolemaic times.

²¹⁵ Lippert 2012.

²¹⁶ *P.Tor.Choach*. 12 = *MChr* 30. See Pestman 1993.

²¹⁷ Doty 1977 for Uruk.

²¹⁸ Clancier 2011, 762.

²¹⁹ *Vorderasiatische Schriftdenkmäler der königlichen Museen zu Berlin* 15, 34, Clancier 2005, 91.

²²⁰ Clancier 2011, 765.

leather records provided a bridge. One cuneiform sales contract detailing the treatment of prebend (temple income) shares of a goldsmith provides explicit evidence for the intersection of the temple legal space and that of civil courts. The document makes reference to another legal text, drawn up by the temple court at an earlier point but referred to in cuneiform syllabic as *kur-ra-pe-e*, identified by McEwan as a rendering of the Greek term *graphe*, which was used to refer to both civil suits and written decisions in Greek contexts.²²¹ Thus, this temple court was able to issue legal instruments not only in the traditional Babylonian style, but also in accordance with the newer civic norms of life under the Seleukids.

The cuneiform archival corpora reflect the affairs of the temples, and the question of the jurisdictional reach of the temple and civil courts is unclear, although it is clear that royal legislation could overrule other contractual agreements.²²² Temple officials could also be called to account in royal courts for their behavior, as documented in an instance where a Seleukid king believed that his donations to the *šatammu* (priest) of the Esagil temple had been misused.²²³ Although the temple courts were in this sense subordinate, one text from the Esagil archive and dated to the Seleukid period records the temple's right to hand down a ruling of capital punishment for the offense of sacrilege.²²⁴ The right to levy capital punishment suggests that the temple courts had considerable power.

In considering the abundant evidence from the Ptolemaic context, and the more attenuated material from the Seleukid world, it does appear the expansion of state-endorsed venues for adjudication in the Hellenistic period could have facilitated economic coordination, but the underlying plurality of law might simultaneously have constrained it. At the same time, recent scholarship on the sociology of law has pointed out that legal pluralism offers a certain benefit in that it creates space for dialogue and negotiation between communities with different normative practices.²²⁵ The legal pluralism of the Hellenistic world was a palimpsest of the complex underlying traditions that could lend individuals within these spaces considerable flexibility in their negotiations for common ground. However, they still had to negotiate, and that had costs. Roman law provided some of that common ground for them.

V.1.2 The Roman Legal System

Like the Hellenistic kingdoms, the Roman Empire consisted of numerous small-scale political units.²²⁶ Unlike the Hellenistic kingdoms, Rome was a city-state be-

²²¹ OCET 9, 42, McEwan 1984.

²²² Doty 1977, 308 ff.

²²³ BCHP 12 = ABC 13B, preliminary publication of new reading of Finkel, van der Spek, and Pirngruber available online at <https://www.livius.org/sources/content/mesopotamian-chronicles-content/bchp-12-seleucus-iii-chronicle/> (accessed 8 February 2021).

²²⁴ BM 47737, Joannès 2000.

²²⁵ Berman 2009, 238; Shahar 2008.

²²⁶ For the political structure of the Roman Empire, see Weaverdyck, vol. 1, ch. 7.

fore it was an empire, and therefore had its own legal tradition. Although jurisdiction was one of the primary functions of Roman magistrates in the provinces, the Romans never sought to impose their legal system on their subjects.²²⁷ Not only did local courts continue to apply their own laws, Roman courts too were usually happy to apply local legal concepts when appropriate.²²⁸ Litigants likely thought less about coherent legal systems and more about what would convince a judge to rule in their favor.²²⁹ Since Roman magistrates could supersede local courts, with the emperor being the final arbiter of justice, litigants might have expected Roman legal forms to be more persuasive.²³⁰ Thus, the use of Roman law became more and more common, but it was never the only system used.

Even if Rome's had been the only legal system in use, the potential for legal inconsistency would have remained because there were several different sources of Roman law and there was never a single body of law in this period that we would recognize as a 'code.' In the mid-fifth century BCE, in its first attempt to establish an authoritative body of law, the Roman state published the Twelve Tables, but its provisions were too piecemeal to be compared to a modern legal system.²³¹ The next attempt would not be made for almost a millennium. Our evidence for Roman law comes in the form of late Roman efforts to compile and standardize a body of law that would have legal force throughout the empire, and we must be wary of retrojecting such systematization to earlier periods.

Roman laws came from a variety of sources.²³² Throughout the Republican period, most of the laws that affected the economic behavior of individuals stemmed from the Praetorian Edict.²³³ This edict determined the grounds on which one could sue another. Provincial governors would issue similar edicts closely modeled on

227 For the application of Roman law to noncitizens, see Weaverdyck, vol. 1, ch. 7, 264–266; Eck 2018; Richardson 2015.

228 Czajkowski 2019, a thoughtful examination of the extent of legal pluralism in the Roman Empire, describes these phenomena as “jurisdictional” and “normative” pluralism, respectively. For jurisdictional pluralism in general, see Humfress 2013a; 2013b, and Alonso 2013 for Roman Egypt, which was unusual in not having a court system that was separate from the Roman jurisdictional system. For normative pluralism in general, see Ando 2016, and Kantor 2013 for the example of Phrygia.

229 See, e.g., Bryen 2014 relying mostly on Egyptian evidence, and Czajkowski 2017 arguing on the basis of the Babatha and Salome Komaise archives found in the Judaean desert.

230 Eck 2018, but cf. Terpstra 2019, 125–167 who argues that Roman contractual forms were adopted because of their role in establishing and maintaining social status through the act of witnessing.

231 Ibbetson 2015, 26.

232 Ibbetson 2015 provides a historical overview of the sources of Roman law. For a very brief introduction of these sources, as understood from a statist perspective, see Riggsby 2010, 25–33. Cf. Bryen 2014 for a much more expansive view that highlights the agency of “end users” in the dialectic creation of law while still acknowledging the particular importance of authoritative actors’ rule-making activity.

233 Weaverdyck vol. 1, ch. 7, 266. For a good overview of Roman litigation procedure, see Metzger 2015 along with Bablitz 2016; Metzger 2016; Rűfner 2016.

that in Rome. These were displayed in written form in city centers throughout the empire.²³⁴ Theoretically, the edicts could change every year, but in practice they tended to build on each other. By the Late Republic, the contents were relatively stable, and in 130 CE, Hadrian commissioned an authoritative, permanent version. The Praetorian Edict, then, formed a relatively stable core of Roman law that, while not as comprehensive as modern codes, performed some of the same functions in terms of providing certainty and accessibility to the ‘rules of the game.’

Around the core of the Praetorian Edict, however, variation was introduced by the interpretations of the jurists and by the legislative activity of the emperor. Jurists were legal scholars who derived authority from their recognized expertise rather than any official position within the state apparatus. They wrote scholarly works but also issued *responsae*, answers to specific questions. Their opinions were highly influential with judges and, from the early second century CE, binding when unanimous.²³⁵ The debates between them, however, were both a sign and source of legal uncertainty.

The emperor’s ability to make law – in the form of edicts, legal verdicts, or responses to petitions – further complicated the issue. The emperor consulted jurists and was somewhat constrained by a civic ideology, but there was no formal limit to his legislative competence.²³⁶ Furthermore, while governors’ edicts were published, it is uncertain who had access to the laws made by the emperor. The recipient of a favorable response might publicize it, but unfavorable responses might have been difficult for others to access. Edicts were sometimes collected and published in reference works, but it is not certain that they were systematically stored in publicly accessible archives.²³⁷

From an economic perspective, Roman law performed some of the functions of an ideal system of formal constraints. The Praetorian Edict provided a relatively stable set of rules, and the social norm that laws should be made public made these rules knowable. At the same time, there was considerable scope for inconsistency in the juristic interpretation of these laws. Tertullian, writing at the end of the second century CE, describes imperial pronouncements as axes that prune “all the wild growth of that ancient forest of law.”²³⁸ In reality, the edicts themselves contributed to the confusion. Nevertheless, there was a systematic core at the heart of the forest that persisted over several centuries, and this core provided some common ground for individuals to negotiate, even if it did not eliminate uncertainty altogether.

234 Mantovani 2016, 28–29.

235 Gaius, *Institutes* 1. 7.

236 Harries 2013, 50–51. The *Constitutio Antoniniana*, which unilaterally extended Roman citizenship to every free inhabitant of the empire in 212 CE, is the most famous imperial deviation from established law. For a subtler example, see *Dig.* 4. 4. 38. *praef.* discussed by Bryer (2014, 352–355).

237 Ibbetson (2015, 33) thinks that rescripts and possibly decrees were systematically copied and stored in accessible archives, but cf. Mantovani 2016, 34–35.

238 Tertullian, *Apology* 4. 7; Mantovani 2016, 35.

V.2 The Efficacy of Law

The legal system only has economic impacts if the law shapes the behavior of economic actors. The most obvious way this happens is through the threat of punishment. The possibility of enforcement does two things: it incentivizes those who are already in a contractual relationship to uphold their obligations, and it encourages people to enter into contractual relationships in the first place by making the adherence of the other party more likely. This outcome requires that each party believes in their ability to sue the other for breach of contract and that the attendant penalty will actually be exacted.²³⁹ Impersonality of the justice system increases the range of potentially suable partners and therefore encourages more economic coordination,²⁴⁰ but in ancient jurisdiction, questions of social status and citizenship often shaped legal outcomes. Furthermore, it is not clear that the state actively enforced the rulings of judges.

In Greek legal systems, citizenship was a key consideration in legal adjudication. Theoretically, a city's law court handled cases concerning its own citizens, so mechanisms for adjudicating cases involving multiple citizenships had to be developed. Bresson argues that, as a rule, disputes concerning contracts would be resolved by the city in which the contract was struck.²⁴¹ Cities also struck bilateral treaties to define jurisdictional competence in cases of disputes between their citizens. In Classical Athens, in the absence of such a treaty, commercial disputes were settled by a port magistrate, who must frequently have been biased in favor of his fellow citizens.²⁴² In the mid-fourth century BCE, however, the Athenians established a more elaborate system for handling cases involving large-scale trade that was open to all.²⁴³ Other commercial hubs, like Byzantion and Rhodes, soon offered similar services.²⁴⁴ Xenophon, in the fourth century BCE, thought that quick, fair dispute resolution would give Athens a competitive advantage in attracting merchants,²⁴⁵ and other cities might have tried this too. Whether these courts actually treated citizens and foreigners equally is not clear, but at least the ideal was widespread.

The efficacy of these courts required that the injured party be able to exact a penalty, which could be difficult if the guilty had no property in the city. In the pre-

239 Lawsuits were a measure of last resort, avoided if at all possible in favor of other means of dispute resolution (Bablitz 2016). Nevertheless, the ability to sue, even if not exercised, shapes behavior (Cooter, Marks, and Mnookin 1982).

240 Impersonality is a key aspect of North, Wallace, and Weingast's (2009) distinction between "natural states" and "open access orders." See also Kehoe, Ratzan, and Yiftach 2015b; Arruñada 2016.

241 Bresson 2016, 321–322.

242 Bresson 2016, 317–322.

243 E. E. Cohen 2005; Bresson 2016, 322–325.

244 E. E. Cohen 2005, 300 n. 55.

245 Xenophon *Poroi*, 3. 3.

Roman Greek world, the right of reprisal provided a costly solution.²⁴⁶ The wronged party, with the approval of their city, had the right to seize goods belonging to the guilty party's fellow citizens. While encouraging the guilty party's city to provide enforcement, this also reduced security. One fourth-century contract forbids a ship from stopping in ports where the right of reprisal might be exercised.²⁴⁷ Thus, Hellenistic courts could apply their laws to noncitizens, but political fragmentation made enforcement costly. After conquest, Roman imperial power allowed jurists to establish a universal principle tying jurisdiction to property: merchants could only be tried in a city in which they had an established place of business or in their home city.²⁴⁸ The plaintiff could then seize the defendant's property in case of a guilty verdict.

Under the Roman Empire, social standing arguably became more important than citizenship in determining access to adjudication.²⁴⁹ In addition to the advantages that wealth still provides today, in Roman courts, social status determined credibility and therefore functioned as a guide to truth.²⁵⁰ At some point before the reign of Hadrian (r. 117–138), a new legal dichotomy between *honestiores* and *humiliores* was recognized, formalizing the differential treatment of higher and lower status people.²⁵¹ Pliny the Younger commended a governor for reinforcing social hierarchies in jurisdiction, saying, when such distinctions are ignored, “nothing is more unequal than that equality.”²⁵² At the same time, Pliny was drawing a contrast with those who did ignore such distinctions in hopes of appearing impartial. The jurist Ulpian urged governors to counteract power imbalances by establishing systems to ensure that all disputants could be heard and have legal representation.²⁵³ Written contracts and the social status of their witnesses could partially ameliorate status imbalances.²⁵⁴ The patronage of a social superior and petitions to higher officials might also be helpful in this regard.²⁵⁵ Thus, while Roman jurisprudence was by no means impersonal by modern standards, people of lower social standing were not completely excluded.²⁵⁶

What happened after the trial, whether the verdict of the judge was actually enforced, is another question. Taco Terpstra has argued that, in general, ancient

²⁴⁶ Bresson 2016, 318.

²⁴⁷ Demosthenes *Orationes* 35. 13; Bresson 2016, 318.

²⁴⁸ *Dig.* 5. 1. 19; Arnaud 2016, 125–127.

²⁴⁹ Here, we use ‘social standing’ and similar terms to encompass both rank, defined by rules, and status, based on esteem (Garnsey and Saller 2015, 136–144).

²⁵⁰ Meyer 2016; T. S. Taylor 2016.

²⁵¹ T. S. Taylor 2016, 354–355.

²⁵² Pliny, *Epistulae* (Plin. *Ep.*) 9. 5.

²⁵³ *Dig.* 1. 16. 9. 4–5.

²⁵⁴ Meyer 2004; 2015; Wolf 2015.

²⁵⁵ T. S. Taylor 2016.

²⁵⁶ For a brief summary of the evidence that lower-status claimants did use Roman courts, see T. S. Taylor 2016, 358–359 with further literature.

states in the Mediterranean and Near East did very little to enforce the decisions of the courts.²⁵⁷ The law dictated the sentence and how it was to be carried out, but left it to the winning side to actually execute the judgment. The role of the judge, Terpstra argues, was to adjudicate the dispute, that is, to decide who is in the right and what obligations exist in consequence. An official decision of this sort gave the winning side the moral authority to mobilize community support in their enforcement efforts. Koenraad Verboven, however, argues that Roman magistrates had the means and discretion to enforce their decisions and probably did so.²⁵⁸ In the mid-second century CE, Antoninus Pius ordered that “those who appointed judges or arbitrators should execute their decisions.”²⁵⁹ Whatever the case, the abundance of lawsuits that occurred in the ancient world testifies to the courts’ effectiveness.

If the authority of the court was the key to community mobilization, imperial courts would have had a particular role to play. Theoretically, in a local community an individual’s social status might give them greater authority than the court’s, preventing enforcement.²⁶⁰ Similarly, in transactions between members of different communities, each party likely had more authority within their own community. Courts associated with the imperial state, in contrast, would have had greater authority than almost any individual, and the origin of the claimants would have mattered less (unless one claimant could effectively assert closer association with the imperial power). As when a litigant petitions a higher official for support in a case against a more powerful opponent, imperial power in the form of courts could flatten locally significant differences. Economically, the effect would be to widen the range of people subject to the formal constraints of the law and therefore broaden the scope of economic coordination.

V.3 The Economic Impact of the Rules

Beyond the existence of laws and court systems to adjudicate disputes, the particular form the law takes has economic impacts as well. Certain laws can encourage people to enter into agreements and invest in productive activities, and they affect the distribution of wealth within society. The nature of property rights – understood as a bundle of rights over something, including the right to make use of something, to derive income from it, and to manage it – could encourage or discourage investment and could concentrate or disperse wealth.²⁶¹ The ability to craft enforceable

²⁵⁷ Terpstra 2019, 13–23 especially; see also Rfner 2016, 265 for a summary of the Roman legal evidence.

²⁵⁸ Verboven 2020, 404–407.

²⁵⁹ *Dig.* 42. 1. 15. *praef.*, trans. Watson.

²⁶⁰ Of course, in such a situation, the individual would probably not have been sued in the first place.

²⁶¹ For this definition of property rights and some of its implications, see Furubotn and Richter 2005, 87–92.

contracts makes complex, risky transactions more secure. Laws governing liability in complex exchanges could encourage or discourage the use of agents, thereby expanding or restricting the scale of economic enterprises.

V.3.1 Property Rights

Property rights are those rights that determine who has the legitimate ability to exploit a resource. In the premodern world, the most important resource was agricultural land, so this will be our primary focus. Property rights come in bundles, of which ownership is one configuration.²⁶² For example, the right to derive income from land, in the form of taxes or rent, might be claimed by the state, the owner, or both,²⁶³ and owners often temporarily alienated the right to use land to tenants in return for rent.²⁶⁴ Rather than treating such property rights individually, we examine three characteristics of property rights that influenced investments in productivity and the distribution of wealth: security, alienability, and accessibility. Secure property rights encourage investment, particularly in the Mediterranean where the major cash crops (grape and olive) take several years to mature; alienability affects the overall value of goods in circulation and incentivizes investment; and accessibility affects the distribution of wealth, and therefore the capacity of people to consume.

Property rights were secured differently in Greek *polis* contexts and in Roman law. Greek city-states maintained records of land that had been sold or confiscated, and similar archives are known from Ptolemaic and Roman Egypt. In Roman Egypt, even liens and mortgages were registered.²⁶⁵ Public registration of property in Rome and the western part of the Roman Empire, on the other hand, served primarily the fiscal purposes of the state.²⁶⁶ A census declaration might have been used as evidence of ownership but was not dispositive on its own, and cadastral maps, drawn up in cases of colonization and land redistribution, did not record changes in ownership. Procedures of sale in Roman law, however, provided some security by limiting opportunities for competing claims to be recognized.²⁶⁷ The most common

262 For ownership and property rights from the perspective of New Institutional Economics, see Furubotn and Richter 2005, 79–133. For a good discussion of ownership from a historical perspective, see Jakab 2015. E. M. Harris (2015) argues that ownership is a meaningful category that cuts across cultural boundaries without acknowledging the analytical difference between ownership and distinct rights to property.

263 Monson (2012, 159–208) has argued persuasively that the amount of income claimed by the state and the way this was assessed influenced investment in Egypt.

264 Kehoe (2007) has analyzed the economic implications of Roman tenancy practices.

265 For registries in Greek city-states, E. M. Harris 2015; Monson 2012, 122–131 for Ptolemaic and Roman Egypt.

266 Arruñada 2020, 261–268 with further literature.

267 Arruñada 2020, 268–277.

method of property transfer was *traditio*, which transferred possession rather than ownership, coupled with *usucapio*, by which a possessor achieved ownership by maintaining unchallenged possession for two years.²⁶⁸ A similar principle was officially extended to the provinces in the late second century CE, though with a longer time frame.²⁶⁹ Nevertheless, the absence of public archives must have increased the cost of litigation and therefore transaction costs, especially for transactions across long distances. To own land in distant places probably required wealth, status, and social relationships to overcome the costs of the transaction.

The right to sell or otherwise alienate land was widespread in the ancient world. Aristotle defined ownership as the right to give away or sell as one wished.²⁷⁰ Theoretically, alienability incentivizes investment by tying the value of land to its future productivity.²⁷¹ Recent scholarship has emphasized the extent of alienable land even in areas previously thought to be characterized by extensive state and temple ownership. Andrew Monson has argued that, in later Ptolemaic Egypt, both temple and royal land could be privately owned, the labels referring rather to their fiscal status. The Romans privatized more land and lifted restrictions on who could own certain categories of land, but private land itself was not an innovation.²⁷²

The accessibility of property rights in land, that is, whose claims to property rights were recognized, was often locally restricted. Hellenistic Greek city-states generally limited the right to own land to citizens.²⁷³ This not only restricted the land market, it must also have restricted credit, since it was hard for a noncitizen creditor to claim land that had been pledged as surety.²⁷⁴ From the Republican period on, Roman governors undercut the exclusivity of property rights in the Greek East by endorsing claims on land made on the basis of Roman laws governing possession.²⁷⁵ The operative question was how the land was acquired, not the citizenship of the acquirer. This allowed wealthy individuals to buy land in the provinces (or lend to provincials in hopes of obtaining mortgaged land) and acquire vast for-

268 For ownership and possession in Roman law, see Baldus 2016; Capogrossi Colognesi 2016; du Plessis 2015; Jakab 2015.

269 Jakab 2015, 122–124. Provincial property rights in Roman law is a field of lively discussion. See Kantor 2017; Jördens 2016 is helpful for Egypt.

270 Aristotle *Rhetoric* 1. 5. 7.

271 Furubotn and Richter 2005, 97–100. Pliny *Ep.* 3. 19 ties the price of an estate partly to the penury of its tenants, which impacts their productivity.

272 Monson 2012. For the summaries of the progressive privatization of land in Roman Egypt, see Rathbone 2007; Minnen 2019 with further literature.

273 For the close connection between landownership and the communal aspects of the Greek *polis*, see Bresson 2016, 225–234; Mackil 2017.

274 Hard but not impossible. The Byzantines passed a law stating that such noncitizen creditors could obtain title to the mortgaged land by paying one-third of the loaned sum to the state (Arist. [*Oec.*] 2. 1347a. 1–3).

275 Eberle 2016.

tunes that dwarfed all but those of Hellenistic rulers.²⁷⁶ Hellenistic Babylon provides an interesting comparison. There, the old system of prebend contracts, which provided shares of income from temple land in exchange for cultic service, expanded from a few families to a range of individuals, including foreigners and women.²⁷⁷ Here too we see an expansion in the accessibility of property rights associated with imperial rule. This might have increased economic activity and integration in the aggregate, but it did so at the expense of local people who had to compete with wealthy outsiders.

V.3.2 Contracts

A contract is an agreement between private parties that is meant to be enforceable by a third party, thereby reducing the risk of opportunistic behavior.²⁷⁸ Without third-party enforcement, parties must rely on their own social resources to ensure their partner's adherence to the terms of an agreement, excluding those with modest resources from complex transactions. Therefore, as forging contracts becomes easier, more complex transactions become feasible to a wider range of people.²⁷⁹ Ancient contracts were originally oral, and enforceability was achieved by expressing agreements using fixed formulas, rituals, witnesses, and oaths.²⁸⁰ Written contracts could serve as evidence for the oral agreement, though in some traditions they became constitutive of the agreement itself. For our purposes, the key question concerns the balance between the cost of entering into a contract and the level of security – the enforceability – that contract provided.

The formal requirements of enforceability affect both the cost and strength of a contract. In Classical Athens, and probably in most Hellenistic *poleis*, there were no formal requirements for written contracts aside from witnesses. On the other hand, the written word carried less weight in court than the spoken word.²⁸¹ The only exception was the maritime courts, discussed above, which required written con-

²⁷⁶ Harper 2015.

²⁷⁷ Corò 2005.

²⁷⁸ For a discussion of the definition of 'contract' in the ancient world, see Ratzan 2015, 188–196.

²⁷⁹ For a theoretical NIE perspective on contracts, see Furubotn and Richter 2005, 135–290. Kehoe, Ratzan, and Yiftach (2015b) and Kehoe (2015) discuss the economic impact of Roman contract law in terms of default rules, the terms that cover situations not explicitly described in the contract, and conclude that Roman default rules were economically efficient from a modern theoretical perspective. Other legal traditions almost certainly had default rules as well based on custom, but what these were and how consistently they were applied is not known.

²⁸⁰ See Meyer's discussion of "unitary acts" that changed the nature of the universe (Meyer 2004, 91–120). Demotic sales contracts sometimes refer to "the oath that will be imposed on you in the courthouse with respect to the right conveyed by the foregoing document" (vel sim. E.g., Keenan, Manning, and Yiftach-Firanko 2014, nos. 6.1.1, 6.1.2, 6.2.1).

²⁸¹ Gagarin 2008, 196–205 for the use value of the written word in fourth-century Athenian trials.

tracts. In Ptolemaic Egypt, in contrast, the form of the contract was more important and was even mandated by the state.²⁸² Greek and Demotic contracts were distinguished from other texts both by the use of certain phrases and by their physical forms. In the course of the third and second centuries BCE, it became customary and then required to deposit contracts in state archives. State support would have made these contracts very secure but also costly to draw up. As an alternative, people would record agreements in texts written as letters that, from the second century BCE, often contained legal formulas, thus compromising between enforceability and cost. In Roman courts too, the physical form of the written contract carried great weight.²⁸³ Contracts were written on wooden tablets (*tabulae*) that, though not technically constitutive of the obligations recorded, symbolized the agreement.²⁸⁴ The tablets were bound with a string and sealed by witnesses and parties to the contract, and in 61 CE, the state stepped in to mandate a new form of sealing to prevent forgery.²⁸⁵ Roman contracts derived their authority from the reputation of those whose seals they bore and the physical form of the *tabulae* rather than any state institution as in Ptolemaic Egypt. Recording contracts on *tabulae* was more expensive than using papyrus, but one was not required to file them with an official archive.

Tabulae carried weight in Roman courts, but they were not required for adjudication. Similarly, being able to repeat the precise words of the Praetorian Edict might have helped convince a judge that one's contract should be enforced, and this would have required the assistance of a legal expert,²⁸⁶ but it was not strictly necessary. From the first century BCE, Roman jurists recognized obligations arising from words (e.g., a promise), actions that do not require words (e.g., making a loan), and agreements (e.g., sale, lease and hire, and partnership).²⁸⁷ The categorization of agreements that gave rise to obligations allowed Roman jurists to develop default rules surrounding them. In essence, if a judge recognized an agreement as a certain type and knew (or was made aware of) the laws concerning that type, a contract with legally binding terms existed without ever having to be written. Similar default rules might have existed in other traditions, either implicit rules dictated by custom or explicitly enacted laws, but the systematization of the Praetorian Edict, the long history and sophistication of Roman juristic writing, and the geographic extent of Roman power that gave those opinions legal force made Roman default rules more powerful than others. Bearing in mind the inadequacies of the Roman courts de-

²⁸² Depauw et al. 2014.

²⁸³ Meyer 2004.

²⁸⁴ Meyer 2004, esp. 90 for the destruction of debt tablets.

²⁸⁵ Meyer 2004, 163–168.

²⁸⁶ A quotation from the Praetorian Edict appears in the Babatha archive. For the importance of reciting the precise words of the Praetorian Edict, see Meyer 2004, 59.

²⁸⁷ For the Roman law of obligations, see Ibbetson 2016. For these contractual forms, see Fiori 2016; Sirks 2018.

scribed above and the cost of hiring legal experts to advise one at a trial, entering into a legally enforceable agreement in the Roman Empire would have been relatively easy.

V.3.3 Agency

Agency, the ability of one person (an agent) to make contracts and transactions on behalf of another (a principal), is a prerequisite for economic activity that transcends the capacity of a single person. Agency creates extra costs both for the principal and for the third party interacting with the agent. The principal bears the cost of ensuring the agent's faithful performance of their duties (the 'principal-agent problem'), while the third party bears the risk that the principal will try to deny responsibility for obligations entered into by the agent.

Legal regulations governing the agent-principal relationship are not strictly necessary for agency to occur. The third-century BCE archive of Zenon, who managed the affairs of Appolonios the *dioiketes*, reveals an extensive, complex network of agents conducting a wide range of business ventures on behalf of a single principal without any apparent legal framework to define or enforce their obligations.²⁸⁸ Mutual monitoring between agents, frequent communication, and the ability to punish faithless agents through imprisonment and confiscation of property allowed Zenon to coordinate the activities of numerous individuals and mobilize resources across great distances. But difficulties and added costs arose when agents dealt with individuals outside their social networks.²⁸⁹ A clear legal framework defining liability and property rights in such cases would not have eliminated such costs, but it might have lessened them by lowering the cost of enforcement. Roman law provided such a framework.

In Roman society, the extra-legal institutions of *familia* and *amicitia* helped principals ensure the good behavior of their agents.²⁹⁰ Within the Roman *familia*, a principal had a variety of coercive mechanisms and incentives with which to influence the behavior of their slave agents. But Romans also frequently asked free peo-

²⁸⁸ Terpstra (2019, 83–124) illuminates the lack of state enforcement in business dealings, although he does not focus specifically on the legal status of agency relationships; for Zenon and Apollonios, see von Reden, vol. 1, ch. 1.

²⁸⁹ E.g., the unnamed individual who wrote to Zenon complaining of being cheated by Zenon's subordinates because he was a "barbarian" (Terpstra 2019, 101–102), or the underhanded slave dealers who demanded a fee for returning runaway slaves that they had just sold (Terpstra 2019, 119–121).

²⁹⁰ The English 'friendship' does not encompass the same range of relationships as the Latin *amicitia*. *Amicitia* included, in addition to those based on mutual affection, relationships defined by stark power imbalances and those that were more instrumental than implied in modern English usage (Verboven 2002; 2011).

ple with whom they had an extrafamilial social relationship to act on their behalf. Many were former slaves, freedmen.²⁹¹ Roman law recognized and enforced the moral obligation of such agents to act in the best interests of their principal and offered ways of formally defining the scope of the agent's legitimate action.²⁹² Standardized categories of contractual agency allowed the principal to sue the agent in case of breach while also allowing the agent to sue the principal for losses incurred in the course of business.²⁹³

The risk to the third party, that the principal would back out of deals made by the agent, was addressed by assigning liability either to the agent or the principal. At some point in the Mid- or Late Republican period, Praetorian Edicts began to contain mechanisms for suing the principal in addition to the agent (the so-called *actiones adiecticiae qualitatis*).²⁹⁴ When setting up an agent in business, the principal would draw up a charter to specify their agent's remit, a copy of which was deposited in the city archive.²⁹⁵ This not only defined the liability of the principal, it also made the agent-principal relationship public knowledge.²⁹⁶ This ameliorated information asymmetry by giving third parties confidence that the agent had the legal right to dispose of the principal's property.²⁹⁷ The wealth of the principal also served to guarantee solvency, allowing third parties to enter into larger transactions than if the agent had been working alone.

Roman law could not eliminate the costs involved in agency, and social relationships and informal constraints always played a major role in shaping behavior. But the law provided additional support. This would have been especially important for people with less social power than the ultrawealthy Apollonios, who could rely on his prestige and social network to enforce the good behavior of his agents. If someone thought they could count on the backing of the law, they might have been more willing to take on greater risk in forming principal-agent relationships or in dealing with an agent. Again, we see the law widening the range of people who could engage in business by lowering transaction costs, thus increasing the scope of economic coordination.

291 For the term and its limits, see Verboven 2002, 230–237. For an in-depth analysis, see Schäfer 1998. For the economic importance of freedmen procurators, see Mouritsen 2011, 206–247; Verboven 2012.

292 Verboven (2002, 227–274) and Arruñada (2020) examine the interplay of social relationships, law, and economics.

293 Aubert 1994, 104–114.

294 The chronology is uncertain: Aubert 1994, 70–100; cf. de Ligt 1999. For descriptions of these *actiones*, see Aubert 1994, 46–70; Johnston 2007; Kirschenbaum 1987, 47–121.

295 Aubert 1994, 9–16.

296 Aubert 1994, 9–12. *Dig.* 14. 3. 11. 2–6 states that, in cases where the principle wants to limit the scope of action of an agent in ways that are not customary, a notice to that effect must be posted publicly. Affirmative publication of the principle-agent relationship was not required.

297 Arruñada 2020.

VI Standardization and Norms

Standardization and the expansion of community norms are tools that increase transparency, lower uncertainty, and reduce chances for miscommunication.²⁹⁸ Despite the regular appearance of standardization in the historical record, total standardization is a mirage, even in the modern world. Nevertheless, “although many if not most standards never catch on, standards still transform the world as we know it.”²⁹⁹ In the case of the Mediterranean and southwestern Asia, standardization does emerge, but on a largely local scale, as is the case with weights and measures. While there were attempts to develop equivalencies between different sets of standards, there was notably less interest in developing a single across-the-board set of standards. The lack of top-down standardization is even more clear in the domain of language, where multilingualism even in state administrative contexts remained the norm. And yet, the Hellenistic and Roman period saw the spread of a wide range of mass-produced objects that were themselves standardized, and which were also a vehicle for the standardization of consumption patterns and, ultimately, taste. This more informal standardization of norms was a consequential force in the development of stable production and distribution networks.

VI.1 Weights and Measures

Following from the earlier discussion of monetization and the eventual expansion of the *denarius* system, one might expect other spheres of weights and measures to have similarly coalesced toward formal standards. In fact, while some imperial standards were widely distributed in space, the picture remains one of great variety. The Seleukids, Ptolemies, and Romans all developed consistent dating systems expressing year, month, and day, but these imperial systems coexisted with local and regional systems that persisted in use.³⁰⁰ Roman land surveyors employed consistent measurements of length and area across the empire, but many people had more faith in their own local units.³⁰¹ Adding to the complexity, units in various standards often shared names: a *mina* in one city did not equal a *mina* in another, and there were at least five different standards of the *modius*.³⁰² This homonymy and lack of consistency would have resulted in increased uncertainty and transaction costs for long-distance exchange, particularly as shared legal frameworks and public infrastructure knit far-flung corners of the Roman world together.

²⁹⁸ See von Reden, ch. 2, II.3, this volume.

²⁹⁹ Timmermans and Epstein 2010, 84.

³⁰⁰ Bickerman 1983; Stern 2012.

³⁰¹ Hyginus 1 *De generibus controversiarum* 92, 24–25.

³⁰² Duncan-Jones 1976. While there are modifiers to identify some of these standards (e.g., *modius castrensis*), there are more standards than modifiers (Riggsby 2019, 92).

Standardization of measurement was always circumscribed. Professional groups that required training and consistency, such as land surveyors or military engineers, maintained high levels of standardization.³⁰³ More commonly used weight and measure standards were city-based, regulated within the context of urban markets under the oversight of local officials (e.g., *agoranomoi*, *aediles*, or *metronomoi*).³⁰⁴ Volumetric standards were physically embodied in measurement tables, large stone slabs with holes of different sizes carved into them, which bear no relation to any supralocal standard.³⁰⁵ Epigraphic evidence commemorates the provision of standard weights and measures, sometimes by an official, but often by a private individual.³⁰⁶ Magistrates enforced these local standards, often by breaking measuring equipment that was found wanting, but the criteria they used to determine equivalence is unclear. Theoretically, equivalency could be established by inscribing an authoritative standard on a measuring implement. But even in Rome, the 55 surviving weights that claim to be calibrated at the Temple of Castor vary from the notional standard, in eight cases by more than 20 percent!³⁰⁷

This inconsistency created negotiation and enforcement costs for long-distance trade. Traders had to agree on a standard,³⁰⁸ and even then quantitative precision could not be assumed. The ‘amphora’ was simultaneously the most common vessel used to ship liquids and a standard unit of volume. But even within a stable type the capacity of individual amphorae varied by up to 20 percent.³⁰⁹ If a shop owner ordered ten amphorae of wine, she could only know approximately how many servings she could sell. When disputes inevitably arose, the legal question never concerned the accuracy of the measures used, but whether they were used fraudulently.³¹⁰ This lack of precision explains why the act of measuring was so important in Roman sales. First-century CE jurists opined that, when goods are sold by quantity, the sale is only complete once the good has actually been measured out, transforming an abstract quantity into a concrete, specific commodity.³¹¹ Without precise standards, the parties to a sale had to agree that the commodity actually delivered was sufficient.³¹² Beyond having faith in the measurements, this required the simul-

303 Riggsby 2019, 123–125.

304 Riggsby 2019, 112.

305 Riggsby 2019, 104–105.

306 Riggsby 2019, 112–113.

307 Riggsby 2019, 101.

308 A second-century imperial decision hints at the possibility of confusion based on regional variation: “No one is obliged to sell, if dissatisfied with the price or the measures, especially when nothing is done contrary to the custom of the region” (*Dig* 18. 1. 71).

309 Riggsby 2019, 105–106.

310 Riggsby 2019, 110.

311 *Dig.* 18. 1. 35. 5; Riggsby 2019, 119–120.

312 See also *TPSulp* 55; Riggsby 2019, 117, for a contract that refers to an explicitly approximate quantity of silver that has been certified by one of the parties involved.

taneous presence of both parties or their agents, not to mention a system of signifying approval, and a system of delegating authority to give that approval. The institutions defining agency relationships outlined above and the other personal networks that structured long-distance trade were necessary in part because of the low level of standardization of weights and measures.

VI.2 Language

Bilingualism was widespread around the Mediterranean basin and southwestern Asia in antiquity, and movement toward linguistic standardization was at best uneven. The successive presence of the Achaemenid, Hellenistic, and finally Roman empires did, however, change language-use practices through the introduction or expansion of specific languages – ‘Official Aramaic,’ Greek, and to a certain extent Latin – across vast territories, and into diverse populations. These widespread languages became ‘mediating standards’ that facilitated the creation of evermore extensive social networks across the space and reduced the costs of interaction between actors from different communities.³¹³ At the same time, local languages persisted, and the use of non-imperial languages in local administration can be understood as a membership standard that gained new relevance as a reaction to the spread of imperial power.³¹⁴ As mediating standards in their own right, local and regional languages would have maintained smaller-scale networks that were distinct from, but partially integrated into, the larger-scale imperial linguistic networks.

The eastward spread of Greek with Alexander’s Macedonian army and its eventual presence in the deep reaches of Central Asia is generally understood as a central driving force behind the phenomenon of Hellenization. As a written language, and particularly as a language of administration that was promulgated through things like official inscriptions and coin legends, Greek exploded across southwestern Asia in the third century BCE. The idiom was even adopted as a marker of political authority in the Arsakid world. Furthermore, the Greek language itself was more standardized. In the fifth and fourth centuries BCE, ‘Greek’ was a number of mutually intelligible dialects,³¹⁵ but the Hellenistic period saw the development of *koine*, a postdialectal version of Greek based on the dominant earlier version of the language.³¹⁶ This standardized and systematized Greek spread through the court culture of the Ptolemaic, Attalid, and Seleukid empires. Foreigners wishing to access

313 Grewal 2008, 21–22 for mediating and membership standards, 71–88 for languages as network standards.

314 Grewal 2008, 86–88 on regional linguistic revivals.

315 Colvin 2010.

316 *Koine* evolved out of Attic-Ionic Greek spoken in the late fourth century in Attica as well as territories in western Asia Minor (Brixhe and Panayotou-Triantaphyllopoulou 1988).

this community now had only to learn one version of Greek, which gave them more or less universal access to the Greek-speaking world, thus expanding the mediatory potential of the language.

Roman conquest spread the use of Latin primarily in the Western Mediterranean. The power of Greek as a network standard, and Roman esteem for Greek culture, meant that elite Romans were usually content to use Greek even in official administrative contexts in the Eastern Mediterranean.³¹⁷ Latin was only insisted upon in certain legal documents concerning Roman citizens.³¹⁸ In this case, language served as an official membership standard rather than a mediating standard. Under Roman rule, Latin and Greek formed two distinct superregional linguistic networks, though the imperial elite, and doubtless others as well, could participate in both.

At the same time, other local and regional languages persisted, defining smaller networks that interacted with those of the imperial languages. Greek never gained traction as a spoken language among non-elites across the Hellenistic space.³¹⁹ Instead, a plethora of languages continued to be spoken by local communities throughout the Hellenistic and Roman periods.³²⁰ Some of these, such as Akkadian, Aramaic, and Demotic, were administrative languages used in inscriptions that would have contributed to the sense that local power structures were distinct from imperial power. The spread of the epigraphic habit represents a standardization of cultural habits surrounding public language representation. These monuments make the ideological importance of local languages visible to us in the present, but they were also tools in the maintenance of those languages as membership standards in the past. This is clearest in the case of Aramaic, which although common in Achaemenid inscriptions, was attested only rarely in Hellenistic-period epigraphic contexts.³²¹ In the Roman period, however, a number of versions of Aramaic, from Nabataean and Hatrene in Mesopotamia to Aramazian in the South Caucasus, came to be used as prestige languages in their own right and as vehicles for the consolidation of local identities within the cities of the Roman East.³²²

The maintenance of local language networks did not entail isolation from or rejection of imperial language networks. The appearance of the term *puf-li-ṭe-e/pu-li-ṭa-nu*, a rendering of the Greek *politai*, in Late Babylonian Akkadian administrative documents demonstrates that the rise of new, nonlocal forms of political

317 In the Republican period, the performative use of Latin in Greek contexts could serve political purposes (Rochette 2010, 282–286; Henrichs 1995, 245 on Cato).

318 Adams 2003b, 186–188.

319 This is in sharp contrast to a later imperial idiom, Arabic, which had far deeper consequences, see Wasserstein 2015.

320 For surveys of linguistic diversity, see Brixhe 2010; Richter 2011, ch. 4; Clackson 2015.

321 See, e.g., steles from Armenia (Khatchadourian 2007). For Aramaic in Central Asia, see Morris, ch. 9, IV.1, this volume.

322 Gzella 2015, 215–216; 2006.

organization could be accommodated through linguistic adaptation.³²³ More positively, bilingual Latin-Palmyrene inscriptions demonstrate how multilingualism allowed people to participate in multiple networks simultaneously. A funerary stele from Britain, commemorating the death of Regina, the wife of Barates, a Palmyrene, bears Latin and Palmyrene texts that commemorate the death differently, using linguistic formulae appropriate to the language.³²⁴ The deployment of (often ungrammatical) Latin on bilingual Latin-Palmyrene funeral monuments erected in Palmyra itself, meanwhile, demonstrates a clearly self-conscious desire by local elites to align themselves with the dominant political and cultural power.³²⁵ These inscriptions display membership in the Palmyrene community (both at home and abroad) and the imperial community simultaneously.

The spread of imperial languages did not standardize language use, but it did provide a standardized idiom that people could use to participate in broader networks if they chose to. It also provided a context in which regional linguistic variation took on greater significance. If the use of Palmyrene instead of an imperial language strengthened ties between Palmyrene speakers, this would have facilitated economic transactions between them not only by allowing them to communicate, but also by contributing to the network of trust.³²⁶ Bilingual Palmyrenes, then, could use imperial languages to communicate with others who would be similarly situated within their own trust network. Thus, imperial languages contributed to economic interaction not only by acting as a mediating standard, but by making local languages into membership standards that strengthened the ties of local networks.

VI.3 Consumption Patterns

In the ancient Mediterranean world, it became normal for people in very different areas to consume similar things. The causes of this standardization in consumption are the subject of perhaps the longest-running debate in ancient history, and we do not pretend to solve the issue here. Rather, we will examine the consequences both for the producers and the consumers. Our main focus will be on ‘bulk luxuries,’ things that were not strictly necessary for biological subsistence but were produced and consumed in large quantities. We focus on *terra sigillata* pottery, glass, and pepper because these were costly to produce and transport. Nevertheless, standardization of demand among sub-elites with the capacity to consume made it economical to produce and distribute them in large quantities.

³²³ Mitsuma 2019 for a recent reconsideration.

³²⁴ Adams 2003a, 253–255. See also the discussion of this monument and its iconography in Mullen 2011, 543–546.

³²⁵ As’ad and Delplace 2002.

³²⁶ Seland 2013 for Palmyrene networks.

The basic idea of what tableware should look like in the Graeco-Roman world was remarkably homogeneous, especially in the first and second centuries CE. Hard-fired, finely made ceramics with a black glossy surface were common in Greece and Italy already in the Classical period, but in the last two centuries BCE, red *terra sigillata* replaced the black and then spread throughout the Roman Empire. Most tableware circulated on a regional or supraregional scale; very few workshops distributed goods throughout the entire Mediterranean basin. However, precision in this regard is difficult to achieve because many different workshops produced similar pottery. Even when potting traditions are distinguishable, they often produce very similar goods that could be considered a kind of ceramic ‘koine.’³²⁷ This is not to deny the existence of variation. There was ‘better,’ ‘worse,’ and ‘different’ *terra sigillata*. The availability of high-quality imported pottery created a demand for local imitations that had most of the same attributes but cost less. Indeed, Astrid van Oyen has pointed out that standardization in some key features is a prerequisite for comparison and competition.³²⁸ Standardization of demand, then, fostered diversification of the market and created opportunities for potters even outside of the main production centers.

The spread of standardized consumption practice was critical because, despite being relatively cheap to buy, *terra sigillata* was difficult to make.³²⁹ The clay had to be refined through a multistep process of levigation to achieve a very fine, regular fabric, and the kiln had to achieve very high temperatures while simultaneously channeling smoke away from the baking vessels.³³⁰ Economies of scale were critical, and kilns fired tens of thousands of vessels at a time. Production was characterized by regional and local nucleation of small production units, each with only a few workers. There was some vertical specialization, above all in the use of specialized kiln operators, but much of the efficiency came from geographic proximity, with separate production units sharing access to natural resources, facilities, specialists, and distributors.³³¹ This industry could only exist because specialist potters could rely on the demand for a specific type of pottery.

Glass is another complex industry that exploded in the Roman world thanks to widespread standardization of demand. The production of glass is a complicated process. The first step involves mixing sand with an alkali flux that lowers the melting point and then heating it to an extremely high temperature. That flux, natron, was available only in a few places, mostly in Egypt. In the late Hellenistic and Roman periods, natron was exported in tremendous quantities from Egypt, and sent

³²⁷ Poblome, Gerçeker, and Loopmans 2017, 87–94.

³²⁸ Van Oyen 2016; van Oyen and Pitts 2017, 15 for a summary of the argument.

³²⁹ Peña 2007, 27–31; Poblome 2013, 86–88.

³³⁰ M. D. Jackson and Greene 2008.

³³¹ Fülle 1997; Mees 2013; Wilson 2008a; Poblome 2013; Poblome, Gerçeker, and Loopmans 2017; Poblome 2016.

to production facilities concentrated along the Syro-Palestinian coast, where specialized furnaces were used to melt together the sand and flux, producing the product known as ‘raw glass.’³³² Ingots of raw glass were then shipped to local glass-makers far and wide.³³³ Broken glass was also shipped over long distances to be recycled.³³⁴ This complex supply chain emerged astonishingly quickly in the Late Hellenistic and Early Roman periods due to the invention of glass blowing. First developed along the Syro-Palestinian coast during the first century BCE, the technique quickly spread throughout the empire.³³⁵ Blown glass allowed for an unprecedented range of glass forms to be created faster and with less raw material than earlier forms. Blown glass vessels became popular across the entire Roman Empire and far beyond its borders.³³⁶ Widespread demand and the interconnectedness of the Mediterranean led to a complex industry producing glass on such a large scale that it became as cheap and utilitarian as terracotta.

Pepper was another commodity that went from a rarified to an everyday luxury in the Roman period.³³⁷ In the ancient world, all pepper consumed in the Mediterranean was imported from South Asia. Pliny the Elder inveighs against it as an example of luxury, but the prices he quotes are not exorbitant.³³⁸ A soldier in Britain bought an unknown quantity of pepper for two *denarii*; the same price is listed for a towel in the same tablet.³³⁹ In northwest Europe, archaeological finds of pepper are limited to military contexts, but in Herculaneum in Italy, pepper was found in a septic tank attached to a building with shops and middling apartments.³⁴⁰ If pepper was so common, it must have been imported in astonishing quantity. Pepper is commonly found at Roman sites in the Eastern Desert of Egypt, including a cache weighing 7.55 kg found in Berenike.³⁴¹ In the 160s CE, a single ship carried perhaps 139 tonnes of pepper from India to Egypt.³⁴² Mayer has recently argued that the direct trade between the Red Sea and India, riding the monsoon winds across the high seas, required large ships that could only have been profitable because of the great demand for bulk luxuries like pepper.³⁴³ Direct trade, in turn, brought down

³³² C. M. Jackson et al. 2018 on the glass production process.

³³³ Gorin-Rosen 2000, 54.

³³⁴ Keller 2005; Giacobelli 1997.

³³⁵ Israeli 1991; Larson 2019.

³³⁶ E.g., Hoppál 2016; Morris, ch. 4, II.1 and V.2.

³³⁷ For Roman pepper consumption, see Evers 2017, 68–74; Cobb 2018a; Mayer 2018.

³³⁸ Plin. *HN* 12. 14.

³³⁹ *Tab.Vindol.* 2. 184.

³⁴⁰ Evers 2017, 68–74; Mayer 2018, 570–573.

³⁴¹ Sidebotham 2011, 226.

³⁴² The cargo of the *Hermapollon* is recorded in the Muziris Papyrus, and the entry generally taken to concern pepper is not completely preserved. De Romanis (2020, 236–245, most recently) argues for a much higher figure, but c.f. Evers 2017, 99–109 for an overview of recent scholarship and notes of caution.

³⁴³ Mayer 2018, even after rejecting De Romanis’s higher estimate for the size of *Hermapollon*’s pepper cargo; see also De Romanis 2020, 61–77.

the prices of all imports. In Mayer's account, the standardization of pepper consumption drove the growth of Indo-Mediterranean trade. Against this maximalist account of pepper imports must be placed the logistical difficulties of crossing the Eastern Desert and questions about the productive capacity of the pepper lands in South Asia.³⁴⁴ But regardless of the precise quantities involved, pepper was consumed in the Roman Empire in quantities that far exceeded previous levels. It was familiar to and desired by millions of people all around the empire – not just the elite – and this demand was a major, if not the primary, driver of Roman involvement in Indian Ocean trade.

The standardization of consumption had economic impacts on the consumers as well as the producers when it helped them participate in a broader network. The use of ceramic tableware, for example, was considered normal, at least for people living in a city.³⁴⁵ *Terra sigillata*, then, could have functioned as one of the membership standards that allowed access to the network of 'respectable' or 'civilized' people. If every community has a network of respectability that excludes outsiders ('us' vs. 'them'), these networks can be linked up if the standards of respectability are similar. Prior to Roman conquest, the standards of respectability were very different in continental Europe and the Mediterranean. But the direct force of conquest and the indirect force of access to a powerful, wealthy network of people who shared the standards of the conquerors introduced new ones. The network power of these standards increased the more people adopted them.³⁴⁶ The use of *terra sigillata* and other bulk luxuries would have contributed to making someone respectable in the eyes of another from a different community and might have signaled (rightly or not) membership in a network defined by a standard conceptual frame, and so acted to lubricate economic coordination across social divides.³⁴⁷

In this consideration of standardization as a tool that shaped economic behaviors, we find many examples of informal, consensus-driven adoption of standards among specific communities (i.e., merchants, political or social elites, citizen bodies), or of standardization driven by consumption patterns. The implementation of formal standards used in a regulatory way across wide territories was far rarer. The few examples of pan-regional formal regulation, as in the case of coinage standards and the use of Latin in critical affairs of Roman citizens, demonstrate that central authorities were able to enforce standardization, even across distances. The fact that they so rarely chose to do so may reflect an assessment that the costs of such enforcement were not worth the benefits. Non-official standardization in the form

³⁴⁴ Evers 2017, 105–109.

³⁴⁵ Dio Chrysostom uses a lack of ceramic dishes to characterize his virtuous rustics as abnormal (*Or.* 7. 47, 75–76).

³⁴⁶ For the concepts of direct and indirect force in reference to the introduction and spread of standards, see Grewal 2008, 35–38.

³⁴⁷ For conceptual frames, see Grewal 2008, 282–284.

of consumption patterns, meanwhile, created durable networks that gave producers access to stable and predictable customer bases while also giving consumers access to social power in the form of recognizable conformity.

VII Technology

The Hellenistic and Roman world has long been considered a period of technological stagnation.³⁴⁸ Recent work is roundly challenging this thesis³⁴⁹ – as well as theories that the availability of slave labor held back technological development³⁵⁰ – but the role of technology in the ancient economy continues to be hotly debated.³⁵¹ It is obvious that nothing like the sustained, progressive series of inventions and scientific breakthroughs that characterized the industrial revolution occurred in antiquity, but there were some inventions, particularly in the context of Hellenistic court society. In any case, historically, most of the economic impact of technology has come from expanded application and improvement of old technologies,³⁵² so the question is, to what extent were new technologies applied, and did old technologies find applications in new areas? Given the fragmentary nature of the archaeological record, this is difficult to answer with any precision, but the example of the water mill discussed below shows that it is easy to underestimate the scope of a technology's application.³⁵³ While most scholarship considers only the aggregate level of a technology's use, we argue that the context of use also makes a difference. Technology that supports key parts of the ancient economy can have significant indirect impacts that are not reflected by its ubiquity.

The economic impact of technology has usually been considered from the perspective of increased efficiency in production because the underlying question usually concerns intensive economic growth.³⁵⁴ We focus, rather, on the ways in which technology shaped economic activity more generally. We see technology as playing

348 Finley 1965 has been especially influential.

349 Greene 2000 refutes Finley 1965 directly. For summaries of the debate, see Greene 2008; Flohr 2016.

350 Greene 2000, 50–51; Wilson 2002, 24–25.

351 Wilson (2002) argues influentially for the positive contribution of technology. See also Schneider 2007; 2019 and the edited volumes Lo Cascio 2006; Oleson 2008. For arguments that technology had little economic impact, see Scheidel 2009; Terpstra 2020. Erdkamp (2020) emphasizes the broader application of existing technology in the Roman world, but sees other factors as contributing more to economic growth. Cuomo (2007) and Flohr (2016) examine technological innovation from a cultural, rather than economic perspective.

352 Mokyr (1990, 6, 9–11) arguing that invention was nevertheless important too.

353 Wilson 2020.

354 E.g. Mokyr 1990; Scheidel 2009, 54–57; Terpstra 2020; Erdkamp 2020 but cf. Schneider 2007, 170.

a positive role in certain key areas: advances in food production allowed cash crops to be grown in more varied places and were particularly important for sustaining urban populations; the application of water power in mining facilitated the production of silver, and therefore coinage; and improved maritime technology, especially hydraulic concrete, increased connectivity and long-distance distribution.³⁵⁵ The role of technology in facilitating trade was just as (if not more) important to the ancient economy as its role in increasing production.

VII.1 Production: Agriculture and Metals

VII.1.1 Advances in Agricultural Production

Agriculture – both in the production of foodstuffs and their processing – is the most obvious candidate for technological innovations that increased productive capacity. The physical technology of water-lifting devices, which became increasingly widespread in the Hellenistic period, increased the amount of land that could be cultivated in areas where irrigation was required (see above).³⁵⁶ There is some evidence for the invention of new tools in the Roman period – a heavy, wheeled plow and a reaping machine – but the actual extent of their use is unclear.³⁵⁷ More significant are developments in agricultural practice.³⁵⁸ Geoffrey Kron has argued that both Greeks and Romans practiced convertible farming, a technique that closely integrates animal husbandry and arable cultivation, with significant investments in fodder crops and high yields of both plant and animal products.³⁵⁹ A growing body of archaeozoological remains shows that Roman-period agriculturalists produced not only larger animals but a greater variety of specialized breeds.³⁶⁰ While some of these breeds already existed in the Classical period, Roman conquest expanded their range. Similarly, Roman conquest extended the range of numerous domesticated plants, and skilled cultivators created new varieties of crops, most notably grapes that would grow in continental Europe.³⁶¹ The tradition of Roman agricultur-

355 Wilson (2002) already linked mining technology to monetization; Erdkamp (2020, 50) highlights the role of maritime technology in facilitating trade.

356 Oleson 1984; 2000; Wilson 2008b, 350–355. For debate over the invention of this technology, see Dalley and Oleson 2003.

357 Plin. *HN* 18. 48 (plow); 72 (reaper), on which Raepsaet 1997 (both); Forni 2006 (plow); Stoll 2016, 244–245 (reaper). For Roman farm equipment in general, see White 1975. Kron, an ardent advocate for the productivity of ancient agriculture (2000; 2008; 2012; 2014), argues that the ubiquity of well-made iron tools are better seen as an indication of rural prosperity than a cause of increased production (2012, 169–170).

358 Kron 2012 for an overview.

359 Kron 2000; 2012; 2014. For Greek agricultural practice, see Amigues 2007.

360 Kron 2014; MacKinnon 2015.

361 Bakels and Jacomet 2003. Grapes: Kron 2012, 162–163.

al writing attests to elite interest in innovative cultivation practices, and might have contributed to their spread.³⁶²

Technological change also affected the processing of primary products.³⁶³ The most important are the presses and mills that transformed olives, grapes, and grain into oil, wine, and bread. Olives and grapes were pressed primarily using lever presses. Innovations in pressing technology – primarily changes in the way pressure was applied, but also in the size and fixture of the beam – follow no single, evolutionary path toward higher productivity, but rather a diverse range of regionally specific traditions that allowed people to press grapes and olives efficiently under a variety of constraints and incentives.³⁶⁴ The development of milling technology can more easily be seen in terms of increasing productivity. By the fifth century BCE, two different developments on opposite ends of the Mediterranean represented significant advances over the Neolithic saddle quern: the ‘Olynthus mill’ in the East,³⁶⁵ and the rotary quern in the West.³⁶⁶ Then, in second-century BCE Italy, the ‘Pompeian’ donkey mill came into use. This consisted of a conical lower stone and an hourglass-shaped upper stone that was turned by a donkey.³⁶⁷ The top of the upper part functioned as a hopper, and when the grinding surface wore down, it could be flipped over to double the useful life of the mill. The combination of animal power, size, and continuous rotary motion made these mills very productive, and their development is often linked to the rise of urban, commercial baking.³⁶⁸

The ability to harness waterpower for milling increased productivity even more. The prevalence and economic impact of the water mill in the ancient world are still debated.³⁶⁹ The necessary technology of the waterwheel and gear system was invented in the Ptolemaic court at Alexandria in the third century BCE, but it was

362 For a recent analysis of this genre as scientific literature, see Thibodeau 2018. For its use as evidence for economic history, see Weaverdyck, vol. 1, ch. 8.B.

363 For an overview of food processing technology in the Graeco-Roman world, see Curtis 2008. For more detailed studies, see Curtis 2001, covering all of antiquity, and Thurmond 2006 for the Roman period.

364 Lewit 2020 provides an up to date discussion of innovations in ancient pressing technology with further literature.

365 Frankel 2003; Curtis 2001, 282–287; 2008, 374; Thurmond 2006, 38–40.

366 Curtis 2001, 336–341; 2008, 375; Thurmond 2006, 40–42.

367 The basic design elements are attested already in the fourth century BCE, but the larger, animal-driven mill dates to the second century (Curtis 2001, 341–348; 2008, 376; Thurmond 2006, 42–46).

368 Curtis 2008, 376; Thurmond 2006, 42–43.

369 Finley famously used their apparent scarcity to argue against the importance of technological change (1965), but subsequent research has shown that they were more common than he thought. Wilson (2020) sketches the history of scholarship. For recent debate about economic impact, see Scheidel 2009, 56–57 *contra* Wilson 2009, 79–80. More recently, Terpstra 2020; Wilson 2020, 179–181.

not widely applied until the first and second centuries CE.³⁷⁰ In addition to mills, water power was applied to kneading machines³⁷¹ and other industrial uses. Most discussion of the water mills' economic impact has focused on how much they increased productivity in the aggregate,³⁷² but the technology might have had an outsized impact in certain targeted applications. Urban life in most of the Roman Empire required not just grain but, for cultural reasons, bread. The use of animal- and water-powered mills and kneading machines helped supply this demand more efficiently.

VII.1.2 Mining and the Production of Metal

We noted above that increased monetization relied on increased supplies of precious- and base-metal coin. While Alexander minted Persian bullion to produce his coins, increased coin supply in the Roman period relied more heavily on increased mining.³⁷³ Recent analysis of lead pollution in Greenland ice cores has revealed in detail both the volume of mining activity in the ancient world and its correlation with the metallurgical content of Roman coins.³⁷⁴ Lead pollution levels rise sharply in the fourth century BCE and continue to climb until the crisis of the Late Republic, when they temporarily fall, only to spike again in the first two centuries CE. This mining boom was accomplished, at least in part, by machines and water management techniques that were invented in the Hellenistic and Roman periods. Unfortunately, the precise chronology of technological innovation and diffusion is impossible to reconstruct.

The most spectacular advances in mining, known from the massive scars they left on the landscape in Spain, came from harnessing the erosive power of water to remove the soil and rock above the metalliferous layer (a process known as 'hushing'). The mine operator would construct large aqueducts to collect water in a cistern on top of a hill and then release it all at once, tearing away anything in its

370 The geographic extent of water mills is still unclear. Wilson emphasizes that the current distribution maps are heavily affected by research bias and is optimistic about the presence of water mills throughout the Roman Empire (2020, 157, 165–167). However, the regionalization of press designs emphasized by Tamara Lewit (2020) should encourage caution in attempting empire-wide extrapolations concerning heavy, immobile technology.

371 Vitruvius *De Architectura* 10. 5. 2; Curtis 2001, 363–365; Thurmond 2006, 66–67; Wilson 2020, 168.

372 E.g., Saller 2002, 265–266.

373 Overviews of ancient mining can be found in Craddock 2008; 2016 with further literature. Wilson (2002) makes a forceful case for the economic importance of technology in Roman mining, but cf. Scheidel 2009, 55–56 for criticism and Wilson 2009, 78–79.

374 McConnell et al. 2018. For a discussion of this and other evidence from air pollution, see Weaverdyck, vol. 1, ch. 8.A, 333–335.

path. Pliny the Elder describes a variant in which tunnels were dug into the hillside first, which would channel the water and increase its erosive capacity. Water running over a slanted surface was also used to break up and sort the metalliferous material directly ('ground sluicing'). By applying knowledge developed in the construction of aqueducts, Roman engineers 'mechanized' much of the laborious, slow digging processes involved in mining, speeding up the discovery and extraction of metal.

Underground mining, using tunnels and shafts, required precise surveying skills to make the tunnels connect, ensure ventilation, and drain groundwater.³⁷⁵ Often, groundwater had to be lifted out of the mine. In addition to bailing by hand, we know of two machines that were used: Archimedes's screw and the treadwheel-operated waterwheel. These were both invented in the Hellenistic era for irrigation but were applied to water management in other domains such as baths, ship sheds, and of course mines.³⁷⁶ Both were powered by a person walking on a revolving set of stairs, and they were used in batteries to lift water out of mines in a series of steps. The ability to remove water from deep mineshafts efficiently made more mineral resources accessible than ever before.³⁷⁷

One final machine must be mentioned: the water-powered trip hammer used to crush ore.³⁷⁸ To minimize the fuel and time needed for smelting, chunks of ore had to be reduced in size. Normally this would be done by humans wielding hammers, but stone anvils have been found at mining sites with rows of deep, regularly spaced depressions that could only have been produced by a machine. One such anvil was discovered in Wales next to a waterwheel pit, suggesting that the machine was powered by water rather than muscle. Given how efficient hushing and sluicing were, crushing ore by hand would have formed a bottleneck in the mining process, so mechanization would have increased productivity significantly.

The technological innovations evident in Roman mining came only partially from the invention of new machines and techniques. The ore-crushing machine just described and hushing might have been Roman inventions, but it was the application of older technology (water management using aqueducts and cisterns and Hellenistic water-lifting machines) on a massive scale that really made Roman mining productive enough to expand the money supply of the empire.

VII.2 Distribution: Maritime Trade

The Mediterranean is characterized by high levels of connectivity,³⁷⁹ but in the period under investigation, technological advances increased that connectivity. First,

³⁷⁵ Craddock 2016, 212–213.

³⁷⁶ Oleson 2000, 229–251.

³⁷⁷ It is no more than a historical curiosity that the first widespread application of the modern steam engine was also pumping water out of mine shafts.

³⁷⁸ Wilson 2002, 21–24; 2020, 168–171.

³⁷⁹ Horden and Purcell 2000.

the maximum size of ships increased.³⁸⁰ Prior to the first century BCE, there are no known wrecks of ships over 100 tons, but between 100 BCE and 300 CE, there are several, with some reaching over 300 tons.³⁸¹ Such large ships were made possible in part by the invention of the chain pump, a water-lifting device used to bail out bilge water.³⁸² It consisted of a series of wooden discs mounted on a loop of rope or chain pulled through a tube. By lifting bilge water farther than a human could bail by hand, the chain pump increased the maximum distance between the bilge and the gunwale. The earliest archaeological example dates to the early third century BCE, and minor improvements over the following centuries made the action smoother.³⁸³ Although most ships remained small, the appearance of large ships had a major impact in two key areas of the ancient economy: they transported grain to Rome and other megacities efficiently, and they carried pepper across the open ocean on the monsoon winds from India to the Red Sea (see above, section VI.3).

The technology that had the greatest impact on maritime trade, however, was hydraulic concrete, used to create artificial harbors.³⁸⁴ Concrete is a combination of aggregate (e.g., gravel) and mortar, which was mostly lime-based.³⁸⁵ Simple lime mortar, long used to coat walls, line basins, and create smooth floors, hardens through contact with the air, so the interior never becomes very strong.³⁸⁶ The mortar in Roman concrete, though, contains volcanic ash that makes the mortar strong and waterproof throughout.³⁸⁷ Volcanic ash is plentiful in west-central Italy, but ash from the Bay of Naples ('pozzolana') is unique.³⁸⁸ Concrete made with pozzolana not only sets quickly but sets underwater, making it possible to build moles and breakwaters much more cheaply than before.³⁸⁹ Prior to this, artificial harbor basins had to be excavated behind natural barriers, quays were built out of ashlar blocks, and breakwaters could be built from rubble.³⁹⁰ Concrete allowed engineers to en-

380 Casson 1971, based primarily on textual evidence, is the standard work on ancient ships and sailing and is still useful. For overviews, see Gertwagen 2014; McGrail 2008. For technological innovations, see Wilson 2011 and contributions to W. V. Harris, Iara, and Arnaud 2011. For ship size, see Casson 1971, 170–173; Wilson 2011, 39–40.

381 Wilson 2011, 39–40.

382 Wilson 2011, 42–44; Bendig 2020.

383 Bendig 2020, 186–191.

384 Concrete, along with mass production of standardized bricks and the invention of the arch, also supported urbanism by making the construction of large, durable buildings cheaper (DeLaine 2006; Wilson 2006). For the economic impact of port infrastructure, see sec. IV.2 above.

385 Gypsum-based mortars also existed (Lancaster 2015, 20).

386 F. A. Cooper 2008, 235–238.

387 Lancaster 2015, 21–29.

388 Oleson 2014, 14–19 for different types of volcanic ash; Lancaster 2015, 21–23 for the terminology.

389 It is also possible that pozzolana allowed bridge builders to set foundations underwater, but no analysis has been conducted to test this.

390 Blackman 2008, 643–644.

close much larger spaces, create much larger quays, and do this in many more places than had ever been possible before. The economic impact is particularly evident in Tunisia, where a shallow bottom inhibits the approach of large ships to shore. The construction of long moles that reached into deeper water allowed the agricultural produce of this fertile area to be exported in bulk to Rome and around the Mediterranean.³⁹¹

The invention and spread of concrete technology is fraught with difficulties because important technological advances built on each other in a long process of experimentation. Marine concrete was probably first used, as early as the late third century BCE, in *piscinae*, fish ponds that were very popular among the Roman republican elite.³⁹² These produced luxurious fish for consumption and sale, but they were also valued for their aesthetic properties.³⁹³ Fish ponds and harbors face many of the same problems, including the need to protect the interior from the violence of waves and to prevent siltation, and literary evidence draws explicit parallels between the two.³⁹⁴ Thus, the technological innovations behind artificial harbors might have developed in the relatively closeknit social milieu of the Roman aristocracy, driven by elite consumption and social competition.³⁹⁵

What is remarkable is how far this technology spread. A recent project has analyzed 36 cores from 11 Roman harbors all over the Mediterranean and found that they all used mortar containing pozzolana ash and had remarkably consistent ratios of mortar to aggregate, despite the fact that the latter was often locally sourced.³⁹⁶ This suggests that the key ingredient in Roman marine concrete circulated along with knowledge of how to use it. When the Jewish king Herodes built the massive artificial harbor at Caesarea Maritima, he probably had access to Roman experts dispatched by the emperor, but this would have been exceptional. Alternative paths of technological diffusion include shippers who traded in pozzolana and taught their customers how to use it,³⁹⁷ the circulation of subliterate instruction manuals,³⁹⁸ and the interpersonal transmission of knowledge between builders. In places where construction happened more or less continuously on a fairly large scale for centuries, a specialized building industry could accumulate a considerable stock of

391 Wilson 2011, 46–51.

392 Blackman 2008, 644; Hohlfelder and Oleson 2014.

393 Hohlfelder and Oleson 2014, 227–230; Marzano 2013, 199–234.

394 Hohlfelder and Oleson 2014, 229 for citations.

395 Roman elite interest in certain areas of technology and engineering, including villa architecture, is evident in the literary sources (Hohlfelder and Oleson 2014, 227–230; Terpstra 2020), but the builders themselves must surely receive most of the credit for innovation. These would have circulated along the coast, working for different patrons who must have taken varying levels of interest in the details of their work.

396 M. D. Jackson 2014, 161; Oleson and Jackson 2014, 8–10.

397 Hohlfelder and Oleson 2014, 223–226.

398 Hohlfelder and Oleson 2014, 230–233.

practical knowledge.³⁹⁹ Given the high level of maritime connectivity and the demand for harbor infrastructure, it is possible that a mobile, loosely bound network of construction workers circulated through the Mediterranean's ports, sharing and accumulating knowledge as they went. However it spread, the technology of Roman marine concrete played a critical role in creating the infrastructure that facilitated movement and exchange across the Mediterranean.

VIII Conclusion

This survey of economic 'tools' – the institutions and social and physical phenomena that actors used in their economic activities – has focused on things that increased coordination and the movement of goods across physical and social space. We began with the tools of the state and moved progressively to tools that were less dependent on political power, but throughout we have seen that the state, by itself, cannot account for economic activity. Fiscal regimes consist of the tools that imperial states used to extract revenue, but even here, the process spread wealth to a variety of people, tax collectors, who cannot be viewed simply as state actors. Different methods of extraction spread wealth differently, but in every case, state demand for revenues enriched private people.

Monetization, dependent on the political authority to mint coins, is arguably the most important factor in economic development in the ancient Mediterranean and Near East. The massive outputs of Hellenistic and Roman states and the creation of large, interlinked monetary networks, along with the institutions underlying credit arrangements, bound large- and small-scale transactions all over our region into a single network of money use (even if the integration of that system was uneven). Here too, however, the state's production of money can only be understood by dissolving the state into its constituencies.

The concentration of wealth at the imperial scale allowed empires to invest in infrastructure that similarly increased production, urbanization, and connectivity across the Mediterranean, but the systems of hydraulic and transportation infrastructure relied on contributions by local polities and individuals as well.

Imperial legal systems similarly coexisted with local systems. In the best-attested cases, the Ptolemaic and Roman, empire expanded opportunities for adjudication by judges whose authority overrode local status differences without creating a unified legal system. Roman law, however, did represent a relatively coherent system of laws that was at least available to people across the empire. The particular provisions of Roman law also lowered transaction costs in such a way as to allow people with less social power to engage in riskier economic activities. On the other

³⁹⁹ DeLaine 2006, 248–250.

hand, by breaking the local exclusivity of property rights enforced by *poleis*, it allowed imperial elites to concentrate wealth.

Imperial states did little directly to enforce standardization. Weights and measures remained loosely standardized at best. Behavioral standardization, informally tied to imperial power, was more profound. The extension of imperial languages created a network that people could join if they chose to and gave added significance to local language networks. The remarkable standardization of consumption practices, which can be seen as a more or less spontaneous result of the power of membership standards in a globalized network, created economic niches for producers and transporters.

We also see the impact of technological development in terms of connectivity. While improved techniques increased agricultural production in general, major improvements in processing technology expanded the range of contexts in which particular, important cash crops (grape and olive) could be produced and facilitated urbanism by efficiently producing bread in large quantities. The application of technology in mining underwrote monetization, new concrete allowed for the expansion of harbor facilities, and developments in shipping technology increased the efficiency of trade. All of these developments contributed to the density of economic networks in the ancient Mediterranean and southwestern Asia. The role of imperial states in these developments was indirect at best. The Ptolemies supported intellectuals at court who invented some technologies, and the Roman emperors' demand for metal and grain could account for the application of technology in mines and shipping.

What, then, was the role of empire in the development and maintenance of the tools that increased connectivity in the ancient Mediterranean and southwestern Asia? States are configurations of power made up of coalitions bound by institutional relationships. In the process of expanding their power, imperial states create various structures that other actors, more or less associated with the state, operated within, around, and sometimes against. The integrating role of empire lies in the superiority of its power. Those most embedded in the state will use its institutions to claim and deploy resources, which sometimes takes the form of a primate city or harbor or an insatiable demand that others can profitably satisfy. More often, less embedded actors call on this superior state power for their own purposes. They use it to seize wealth in the form of taxes, to convince someone that a piece of silver is valuable, to sue someone who would otherwise be untouchable, or to convince someone of their social status by adopting language and other signs associated with empire (or more rarely by rejecting those signs). The empire, and the power it offers to those who accept that it is powerful, then becomes a common point of reference, allowing people to interact and relate to each other wherever its power is acknowledged. Unlike nonstate points of reference (e.g., Hellenism), empires include military and economic power that state-dependent actors can deploy to ensure the superiority of their power is acknowledged. In this way, the violent expansion and maintenance of imperial power can spread an overarching structure that facilitates integration.

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